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Observations and Experiments on Pus.

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[From Nicholson's Journal, for 1811.]

CHEMICAL writers vary in their statements of the properties of pus; and they consider, that a farther investigation is requisite for the purposes of science. Physicians confess, that, in numerous cases, they cannot form a satisfactory judgment of the nature of diseases, on account of not being able to determine what is, and what is not purulent matter; likewise probably, on account of the existence of different kinds, or varieties, at least, of this substance, afforded by different disorders.

I beg leave, therefore, to submit to this learned society, my own observations, experiments and reasoning on this animal matter.

SECTION I. *Simple, and obvious Properties.*

The different kinds of fluid, commonly considered to be pus, may be distinguished by the following titles:

I. The creamlike and equally consistent.

II. The curdy and unequal in consistence.

III. The serous and thin kind.

IV. The thick, viscid or slimy.

* Philosophical Transactions, for 1810, p. 294.

I. A pint of the first sort was taken out of the pericardium, after a fatal inflammation of the heart, in St. George's hospital, and obligingly sent to me by my colleague, Dr. E. N. Bancroft.

The *colour* was yellowish—the *smell* was fleshy when warmed—it was smooth and unctuous to the touch.

2. The specific gravity of two different portions was as 1630 and 1633, that of distilled water being 1580; each substance being of the same temperature. Serum, of the blood of different patients, was found at the same time to be 1626, 1627, and 1630. Accordingly, the distilled water being 1000, the pus is 1031, and 1033; and the serum is 1029, and 1031.

3. After twelve hours repose, about two ounces by measure of a limpid fluid having appeared on the top, it was decanted from off the opake purulent fluid; which was become thinner in the upper part of the vessel containing it, and thicker in the lower than before.

4. On farther repose, it did not become offensive so soon as a portion of the same pus mixed with a little blood, or as serum alone.

5. This pus neither indicated acidity nor alkalescency to the usual tests; viz. turnsole paper, tincture of red cabbage, Brazil-wood paper, and turmeric paper. I have, in other instances, sometimes observed acidity to be indicated by turnsole paper; but in none alkalescency, so long as the matter remained without fetor.

6. Being examined under the microscope, when duly diluted with distilled water, innumerable sphericle particles were seen, which did not appear altered in figure, or diminished in number, by extreme dilution; that is, they did not appear to have been dissolved.

II. A pint of pus of the second kind, viz. *curdy*, was afforded by a psoas abscess.

The colour was brown. It felt knotty. On pouring from one vessel to another, the curdy masses were manifest, and of various sizes, from that of a pin's head to a hazel nut. It was more viscid than the former, and of a little greater specific gravity. On standing, a limpid fluid appeared upon the top, as in the first kind, but in smaller quantity. Globules were seen with the microscope, but also a number of irregularly

figured larger masses. Putrefaction took place sooner than in the former kind. In other properties, this pus was similar to the first kind.

III. *Serous thin pus.* It was produced by a fatal inflammation of the peritoneal coat, without ulcer, and taken out of the cavity of the abdomen. A good deal of serum was also effused, of which the pus was a deposit. It was not much thicker than milk. To the feeling it was not at all unctuous. The smell was slightly offensive. On standing twenty-four hours, a sediment appeared, occupying only one half the full vessel, under a wheylike liquid. Putrefaction took place sooner than in either of the two former kinds. The specific gravity was the same as that of the first sort. In other properties it was similar to the creamlike pus above distinguished.

IV. A pint of the *viscid pus* was obtained from an abscess among the muscles of the thigh. If I had not had entire confidence in Mr. Brodie's accuracy, who was so obliging as to attend to my request, on this and many other like occasions, I should have supposed, that this was expectorated matter, it so exactly resembled in its simple properties the *ropy kind*, described in a paper on expectorated matter. Phil. Trans. 1809, P. ii. p. 317.

The appearance was not quite uniform, there being semitransparent masses in small proportion, mixed with the perfectly opake white matter. It was almost inodorous. To the touch it was quite smooth. The specific gravity was nearly that of the second kind of pus.

On standing twenty-four hours, about one ounce measure of limpid fluid rose to the top of the whole mass. Putrefaction did not take place so soon as in expectorated matter of the same consistence.

The examination by the microscope manifested innumerable spherical particles among leafy masses, and numerous particles of irregular forms.

The simple properties were otherwise similar to those of the other sorts of pus, above distinguished.

Many other differences of purulent matter are universally recognised; but they are either varieties of the four kinds already named, or the differences depend upon the obvious mix-

ture with adventitious substances; such as the red part of the blood, coagula d lymph, serum, putrefied matter, fibrous and membranous masses, calculi, &c.: therefore, I deem it useless to describe them.

Sect. II. *Agency of Caloric.*

1. The above kinds of pus coagulated like serum of blood into a firm, uniform, soft solid, at the temperature of 165° completely; but partially at 160° of Fahrenheit's thermometer.

2. The decanted limpid fluid from pus, sect. I. II. III. IV. coagulated completely into a firm uniform mass, like serum of blood, at 165°, but it became opake and thickened at 160°. By pressure of the firm curd thus produced, a watery liquid was separated, which on due evaporation did not give a jelly, but was coagulable like the decanted liquid just mentioned.

The thick opake matter, after decanting the limpid fluid, coagulated as before said, into a firm mass at 165°.

3. Each of the above four kinds of pus, being evaporated to dryness, left in no case less than one tenth of its original weight, or more than one sixth; but most frequently one seventh or one eighth of brittle matter. The smallest proportion of residue was left by the 3d, or serous kind; the largest, by the 2d or curdy. These residues generally became rather soft, especially those of the 3d, or the serous kind, after exposure to the air.

4. The opake part of pus, after separating the limpid fluid, afforded on evaporation from $\frac{1}{15}$ to $\frac{1}{30}$ more of brittle residue, than an equal weight of the pus itself; and it remained hard on exposure to the air. The limpid fluid, evaporated to dryness, yielded about one tenth of brittle residue, which grew moist, and sometimes deliquesced, on exposure to the air.

5. The brittle residues above mentioned (3), being exposed to fire in platina crucibles, flamed for some time, emitting a very offensive, pungent, empyreumatic smell; the uninflammable residue being kept in a state of ignition for a longer period, what remained at length was fused readily from the *serous*, viz. the third kind of pus; but in the cases of the other exsiccated residues of the 1st, 2d, and 4th kinds of pus, they barely were melted, or only became soft and claggy. The

fused residues from the *serous pus* amounted to $\frac{1}{30}$ or $\frac{1}{35}$ of the exsiccated pus; and to $\frac{1}{250}$ or $\frac{1}{300}$ of the original purulent matter. Those from the second kind, the *curdy* amounted to $\frac{1}{50}$ or $\frac{1}{60}$ of the dried matter, and to $\frac{1}{350}$ or $\frac{1}{400}$ of the pus itself. The fused masses from the 1st and 4th kinds of purulent matter afforded intermediate quantities of melted matter between those just mentioned.

6. The fused residues (5), being treated in the manner described in a former paper, Phil. Trans. 1809, P. ii. p. 326. 329, I found they consisted chiefly of muriate of soda, phosphate of lime and potash; with strong indications of carbonate of lime, and a sulphate; beside traces of phosphate of magnesia, oxide of iron, and vitrifiable matter, probably silica. On a reasonable calculation, it appeared, that in the *serous kind* of pus, the muriate of soda amounts to from one and a half, to two per 1000; the phosphate of lime from one, to one and a half per 1000; the potash from one half, to three fourths of a part in this quantity; and the other matters together, to half a part in 1000. In the *curdy matter*, the second kind, the muriate of soda amounts to from three fourths of a part, to one in 1000; the phosphate of lime to one; the potash to less than one half; and the other matters united, to a half part in 1000. The first kind of pus, the *creamlike*, and the fourth the *viscid*, afforded from the melted residue the same substances as the *serous* kind, excepting a somewhat smaller proportion of muriate of soda, and potash.

7. The brittle residues of evaporated pus, after decanting the limpid fluid (4), being treated with fire as above related, the remaining matters were melted with more difficulty, and less completely, and contained a smaller proportion of muriate of soda and potash than the original pus.

8. The decanted limpid fluids (4), being evaporated to dryness, these residues were exposed to fire. They were melted, and then afforded a larger proportion of muriate of soda and of potash, than the pus itself; but with the same proportion of the other saline and earthy substances.

Sect. III. *Agency of Water.*

1. After decanting the limpid fluid from off half a pint of the four kinds of pus as above related, (sect. I.) three ounces by measure of distilled water were mixed with each of them. After forty-eight hours' repose, a limpid fluid of nearly the quantity of two ounces by measure was seen forming an upper stratum to the pus. It was decanted for examination.

(*a*) On exposure to fire it became turbid like milk, as soon as the temperature was elevated to 165°, but did not become thicker at a greater elevation.

(*b*) On evaporation to dryness, the residue amounted to about one fifteenth of the weight of the liquid from the serous pus, and to one twentieth from the three other kinds; in place of about one tenth, as from the first decanted liquid, (Sect. I, 4); and as from serum of blood. The residuary matters were of the same kind as those above described, Sect. II, 2—6.

(*c*) Three ounces by measure of distilled water having been again mixed with each of the four kinds of pus, and, in forty-eight hours, two ounces measure of decanted limpid fluid from each having been evaporated to dryness, residues of the same kind, in the same proportions, and in nearly the same quantities as before, were obtained (*b*). These decanted fluids became nearly as turbid as the former, on raising their temperature to 165°.

(*d*) Distilled water was added a third time, in the quantity of eight ounces by measure, to each of the four parcels of pus under examination; and, after forty-eight hours' repose, six ounces of limpid fluid were poured off from each of them. At the temperature of 165°, the decanted fluids became turbid, that of the serous pus more so than the others. On evaporation to dryness, a much smaller quantity of residue was obtained than before, viz. one sixtieth from the serous pus, and one seventieth from the others; and it consisted of the same kind of substances as above described; but the muriate of soda and potash were in smaller proportions than before.

(*e*) A fourth time distilled water, in the quantity of a pint, was mixed with the present four parcels of pus; and after standing forty-eight hours, three fourths of a pint of clear

colourless liquid was poured off from each of them. It became slightly turbid and whitish on boiling. On evaporation, each parcel afforded about $\frac{1}{90}$ of the fluid employed. The residues now consisted of animal matter, with a much smaller proportion than before of muriate of soda, phosphate of lime, and potash—nothing else could now be traced.

(*f*) Distilled water, in the quantity of a pint, was once more mixed with the four sorts of purulent matter undergoing inquiry. After forty-eight hours, a pint of liquid was decanted from off each of them; but being slightly turbid, they were left to stand twenty-four hours. By this time a sediment was deposited from each of the liquors; but being still, though very slightly, turbid, they were filtrated through suitable paper. They were then transparent. The transparent filtrated liquors had their transparency disturbed by a boiling temperature. They became also slightly milky with a nitrate of silver, but scarcely so with infusion of gall nut. On evaporation to the quantity of an ounce from each pint, the residuary liquids appeared slightly globular. These, on evaporation to dryness, yielded not more than one part of animal matter, from each 500 of the transparent filtrated liquids.

(*g*) On standing three or four days in a cold room, the parcels of pus, after the ablutions just related (*a*—*f*), exhibited a whey coloured liquor at the top, of which about $\frac{1}{4}$ of a pint was poured off from them. More turbid liquor was also separated from the washed pus, by pouring it upon a porous cotton cloth strainer, which left purulent matter of the consistence of starch mucilage, amounting to about one half the original weight.

(*h*) The pus freed from coagulable limpid liquid by repeated ablutions (*a*—*h*) was white as snow—equal in consistence—perfectly smooth—the fourth kind was less viscid than before, but the others were more so—no smell—not at all disposed to putrefy—on elevating its temperature to 165° and higher, it did not coagulate into one mass, nor into clots, or large masses of curd, but a watery fluid separated from a fine soft somewhat curdlike opake fluid; which did not become more curdy, even on boiling—it did not appear that above a grain of this part, or state of pus, dissolved in 1000 waters—was highly globular

under the microscope, and remained so, although coagulated by nitrate of silver; by infusion of gall nut; by alcohol; and supersulphate of alumina—with muriate of ammonia, nitrate of potash, and other neutral salts, and with carbonate of potash, it produced a viscid semitransparent mass like expectorated half transparent matter—exposed to fire in a platina crucible, it was inflamed, but did not omit an offensive smell, and after continuing the ignition, the residue was a particle of half fused matter, not amounting to $\frac{1}{3000}$ of the pus after ablution, nor above $\frac{1}{300}$ of the same matter exsiccated; it consisted of phosphate of lime and vitrified matter—no ammonia was perceivable, on mixing lime with this washed pus; nor muriatic acid on adding sulphuric acid.

2. (*a*) A teaspoonful of the *creamlike pus*, being agitated in half a pint of distilled water, produced a milky fluid, with a number of small curdy particles suspended, but very few leafy or fibrous pieces or clots.

(*b*) The *serous pus* being treated as just mentioned (*a*), the same appearances ensued.

(*c*) The *curdy pus* being agitated in the same manner in water, a number of clots, leafy, and fibrous masses, were seen suspended among fine small curdy particles in a pearly liquid.

(*d*) The *viscid pus* being treated as just said, it required long continued and violent agitation, to diffuse it through the water, and then the appearances were as last described.

3. Pus of any kind, after boiling in twenty times its quantity of water, was quite as globular under the microscope as previously. With a smaller proportion of water, the mixture became very turbid, sometimes clots were formed in a pearl liquid, in which a fine sediment took place, which appeared much more globular than the clots or curdy masses.

4. In general, water in which pus has been agitated remains somewhat milky, with an abundant close white sediment; but after two, or three, or more ablutions, the water becomes clear on standing, and the sediment more curdy.

Sect. IV. *Agency of Alcohol of Wine.*

The different kinds of exsiccated pus exposed to the agency of this menstruum, and treated as described in a former paper,

Phil. Trans. 1809, P. II. p. 329, the results were similar, except in the proportion of products.

1. These exsiccated substances afforded to this menstruum a smaller proportion of potash, but as much animal oxide and muriate of soda, as mucous sputum.

2. The undissolved matter left after repeated digestions in this menstruum afforded the same substances, but in smaller proportions, as mucous sputum.

3. Equal bulks of fresh pus, and rectified spirit of wine, afford a much thicker and more milky liquor, with a closer sediment, than expectorated mucous matter.

Sect. V. *Agency of acetous Acid.*

The purulent matters mixed with this acid became curdy, and rendered it milky; but on standing, a close white sediment appeared, the liquid above being clear, except in the case of the viscid pus, which exhibited leafy and fibrous masses, as hath been described with mucous sputum.

By repeated digestion of the different kinds of pus in this menstruum, I obtained the same results, except the proportions of acetite of potash, and muriate of soda being smaller, as related in a former paper on mucous expectorated matter. Phil. Trans. 1809, P. ii. p. 336.

Sect. VI. *Some Experiments with different Objects, especially to distinguish Pus and Mucus.*

1. In the agency of sulphuric, nitric, and muriatic acids, in sufficient quantity to dissolve and decompound the substances under inquiry, I could perceive no important difference between them. The purulent matters indeed required a much greater proportion completely to dissolve them, than the transparent sputum. Also, the more opake and dense the sputum, the greater the resistance to dissolution. Sulphuric acid produced black liquids like those containing charcoal, smelling strongly of muriatic acid; but on dilution with water, they became clear. No precipitation occurred on dilution with water, and on saturation with the fixed alkalis, but a trifling sediment appeared, which redissolved on the addition of the above acids.

2. The mineral acids diluted, or added in small proportion, and the vegetable acids, coagulate variously pus and mucous fluids. Some become merely milky fluids, others curdy fluids, others afford fibrous and leafy masses in a transparent liquor, and others give a uniform thick mass of curd. On standing, the deposits are accordingly of various forms, and the liquors above of various appearances; but I could discover no constant characteristic property of the substances by these experiments, as some writers have asserted.

3. The solid fixed alkalis, or lime, mixed with expectorated mucus, occasion a stronger smell of ammonia than with pus; or than with muco-purulent sputum. Some use may be perhaps made of this easy experiment to judge of the nature of varieties of the fluids in question, particularly as far as depends on the proportion of ammonia; for sometimes it cannot be perceived by the smell on mixing alkalis, but can by muriatic acid giving white vapours. Concentrated liquid alkalis, added to both pus and mucus, dissolve them to produce clear liquids, except small curdy parts and motes. These curdy parts and motes resist dissolution also for some time even in nitric acid, and seem to be self-coagulated lymph. They are in much greater proportion in pus than mucus. The addition of acids to these alkaline dissolutions occasions precipitations: but no differences, or not with sufficient uniformity to afford criteria, were observed according to the observations of other experimenters.

4. Concentrated aqueous solutions of various neutral salts, viz. muriate of ammonia; nitrate of potash; muriate of soda; sulphate of soda, &c.; being mixed in due quantity with pus of the kinds under examination, produce viscidity, like ropy expectorated matter, thickening like jelly, and less opacity. These changes have, in the case of muriate of ammonia, been called coagulation by Mr. Hunter; but by agitation in cold water the matters are diffused, and on standing, the pus is precipitated in its original state. I call these effects of the neutral salts inspissation, seemingly occasioned by their attracting water from the pus; for no such change is produced if either the purulent matter, or solution of salts, be diluted; nor is it produced if the pus be previously coagulated by caloric: also

the inspissated pus is coagulable by caloric as usual. No such inspissation is produced by these salts in mucous sputum, or in muco-purulent sputum, so that undoubtedly it is a criterion as discovered by Mr. Hunter in the case of muriate of ammonia, and with other neutral salts, as now manifested.

5. I endeavoured to find some easy tests for distinguishing pus from mucus; but I did not succeed with the tanning principle; gallic acid; supersulphate of alumina; nitrate of silver, and other metallic salts; and as already said, various acids. They all produced precipitation of these animal matters, but not with observable characteristic differences.

6. To observe the state in which the matter of pus is secreted, I procured the assistance of Mr. Maynard, the present house-surgeon of St. George's hospital, and Mr. George Ewbank, who had been on many occasions essentially serviceable in my inquiries. Square pieces of goldbeater's skin were applied to various sore legs after carefully removing the matter already secreted. In five or ten minutes the square pieces being removed, they were found wet with a limpid fluid. In this state they were inspected by the microscope, by which numerous globules were seen. In ten minutes farther the liquid was no longer limpid but opake, like pus, in which the usual sphericle particles were seen with the microscope as just mentioned.

Supposing objections might be offered on account of the alteration of texture of the skin employed, square pieces of glass were also applied. The results were the same in both trials. The two gentlemen above named, as well as Dr. Richard Harrison, and other pupils, who happened to be present, all concurred in the observation, that the limpid matter became opake, and that while limpid it was, like pus, full of spherical particles.

The statement of the properties of pus in the foregoing inquiry I hope will be found to be true; and I submit to the judgment of others whether or no the following inferences are legitimately established.

1. That this fluid essentially consists of three distinct substances, viz. 1. An animal oxide, which, among other properties, is distinguished by its being white, opake, smooth, of the

form of fine curdy particles in water; not dissoluble in less than 1000 cold waters; not coagulable into one mass like serum of blood by caloric, alcohol, &c.; only rendered more curdy by water from 160° to 170°; but readily diffusible.—2. A limpid fluid resembling serum of blood in its impregnations, and in its coagulability by caloric, alcohol, &c.; in which the opake oxide is diffusible but not dissoluble, and which is specifically lighter than that oxide.—3. Innumerable spherical particles visible only by the microscope in this opake oxide, and in small number in the limpid fluid; not coagulable by any temperature to which hitherto exposed, and not destructible by many things which combine or destroy the opake oxide; and these globules are specifically heavier than water.*

2. That the *visible* curdy masses, as well as the fibrous or leafy parts, almost always contained in smaller or larger quantities in pus, may be considered as self-coagulated lymph, which in its fluid state is secreted without having the state of aggregation produced in it like that of the *essential* opake oxide of pus.—Sect. VII, 1.

3. That the reddish, the blackish, and the dark brown colour of pus depends upon the red part of the blood effused or secreted from the same vessels, or from contiguous ones which secrete pus.

4. That on some occasions the clotty and irregularly figured masses found in the pus may depend upon disorganization or breach of the contiguous solid parts.

5. That whenever pus is fœtid to the smell, a portion of it is in the state of putrefactive fermentation, which may be removed by ablutions with water.

6. That there are certain adventitious matters liable to be contained in pus not hitherto rendered palpable to the senses, but known by their effects in exciting contagious diseases; such as small-pox, syphilis, &c. These matters are, produced by a specific action in the secretory organs of pus, by such matters

* My obligingly attentive pupils, Mr. Burton, and Mr. Stansfeld, house-surgeons of the Lock hospital, collected for me a sufficient quantity of gonorrheal matter to determine, that it consisted of the three ingredients here stated.

themselves either contained in the circulating blood, or on the secreting surface.

7. That the *essential* substances of which pus consists, as well as some of the adventitious ones (Sect. VII, 1, 2, 3, 6.) are separated from the blood by a peculiar organization belonging, or attached to the bloodvessels: which organs of separation or secretion are not only excited to the action which produces pus in diseased states, but they are evidently influenced by the states of other distant organs of the animal economy; hence many varieties in the properties of the purulent matter.

8. That the varieties of purulent matter relate to differences of *quantity*—the proportion of the essential substances (1)—and the adventitious parts (2, 3, 4, 5, 6,). The *cream-like* pus consisting of almost purely the opake oxide and limpid liquid (I, 1, 2,). The *curdy* containing a large proportion of coagulated lymph, or broken down solids. The *serous* abounding in limpid fluid. The *viscid* depending upon the coagulation, and perhaps, inspissation, by union of neutral salts with the opake oxide.

9. That as the essential parts are secreted in a limpid state, but presently become opake, owing to a large proportion spontaneously coagulating, and thus becoming the opake oxide, mixed with the serous liquid, and innumerable spherical particles (Sect. VII, I, 1, 2, 3,) it seems reasonable to infer, that these matters are the self-coagulated lymph of the blood and serum, separated by the secretory organs; which act of secretion determines the subsequent state of aggregation of pus, and the globules are at the same time formed analogously to their formation by other secretory organs. How far they are those of the blood altered by secretion may be determined hereafter. It is a collateral proof of this inference, that very thick pus affords from one sixth to one seventh of exsiccated brittle residue, which, as I have found, is nearly the same proportion afforded on the exsiccation of the buffy coat of inflamed blood; while very thin pus affords on exsiccation from one eighth to one eleventh of brittle residue, which is the proportion to be expected from a mixture of serum of blood and self-coagulated lymph, as I have ascertained.

10. That the constant impregnating saline and earthy ingredients of pus are dissolved in the serous fluid; and are all seperable along with the serum, by ablutions with water, from the opake oxide (1), except a portion of the phosphate of lime. These impregnations are the same as those of serum of blood, and of expectorated mucous matter, viz. muriate of soda; potash neutralized by animal matter or a destructible acid; phosphate of lime; ammonia neutralized probably by phosphoric acid; with a sulphate, and traces of some other matters mentioned in my former paper. The proportion of these impregnating substances is as the proportion of limpid or serous coagulable fluid, and of course inversely as the proportion of the opake oxide of pus; but it varies in different cases in given proportions of this oxide, and the limpid fluid. In general, if not always, a given quantity of pus contains a smaller proportion of saline matters than an equal given quantity of expectorated mucous matter, but a given quantity of the limpid coagulated fluid contains a greater proportion of saline matters than an equal given quantity of serum of blood. Hence the thicker the pus the less irritation to the sore which secretes it, and commonly the less the inflammatory or other action of the secreting surface. In different cases, however, the proportion of impregnating saline substances to one another is liable to vary, especially that of phosphate of lime; hence, though rarely, calculi occur of this substance in the cavity of the abscess.* Hence too the exsiccated pus is liable to become soft and moist, from the proportion of neutralized potash being greater than usual; and even deliquescence sometimes occurs of the exsiccated limpid fluid.

12. That the same organs, according to their different states, secrete from the blood merely water impregnated with the saline substances of the serum of blood; also this fluid con-

* On examining the lungs of a patient who died of pulmonary consumption, concretions were found in a large vomica from the size of mustard seed to a pepper corn, which Dr. E. N. Bancroft reserved for my inquiry. I found they consisted chiefly of phosphate of lime, with an unusually small proportion of animal matter. In another patient of Dr. Nevison, matter was coughed up, consisting chiefly of phosphate of lime and animal matter, nearly one of the former to three of the latter.

taining various proportions of coagulable matter like that of serum of blood; and serous fluid with self-coagulable lymph, which affords curdy masses: likewise this serous fluid, together with this matter which coagulates of itself after secretion, highly impregnated with invisibly small particles, in such a state of aggregation, as to constitute the thick opake fluid called pus—which states of the secretory organs are generally attended with inflammatory action, but frequently also without any symptoms of such action.

13. That beside the consistence of pus depending upon the proportion of serous limpid liquid, and opake matter, it also probably depends upon the mode and state of coagulation of the matter which affords this opake part; analogously to the different states of consistence of the coagulated blood itself, according to the different conditions of the animal economy.

According to the above inferences, I trust, a distinct and definite notion of the substance to be considered as pus is exhibited; and I do not comment on the different results of experiment and conclusions of other writers, because future observers only can determine the truth. What is and what is not pus will now readily be ascertained by a few easy experiments; by the obvious properties; and by the consideration of the source of the matter in question: provided, however, that it be unmixed with certain other matters, by which disguise is produced. As already observed it is in pulmonic diseases that the ambiguity occurs; and physicians lay very considerable stress upon the nature of expectorated matter in their practice and reasoning; I shall therefore endeavour to elucidate the subject by remarks on the puriform matter expectorated in different cases.

1. An abscess occasioned by acute inflammation not only of a pleurisy, and peripneumony, but of other diseases which have not the symptoms of any one which has received a designation. Here there ought to be no doubt; for the matter which is coughed up suddenly and abundantly on the bursting of the abscess is evidently pus with little mucus. Such matter consists of the essential ingredients of pus, (Sect. VII, 1,) with generally the adventitious substances, (Sect. VII, 2, 3, 4.)

viz. coagulated lymph, membranous or fibrous parts, and a small proportion of the red part of blood.

2. Purulent expectoration from the rupture of abscesses, or vomicæ of suppurated tubercles. In such cases there has been a chronical cough with viscid sputum, commonly in persons of an advanced age. After this long continued disease, an abundant expectoration of quite a different kind from the former suddenly comes on; by which the patient often dies very speedily; sometimes immediately, being seemingly choked. This kind of matter evidently consists chiefly of the essential ingredients of pus, (Sect. VII, 1.) with not only the adventitious substances, viz. clots of self-coagulated lymph, and sometimes the red part of blood, but also masses, which are apparently the broken down solid parts, the cellular membrane, the vessels and substance of the tubercles, in a disorganized state. The sufferer often says, such matter tastes sweet. The mucus is here in too small a proportion, and not intimately mixed, to occasion disguise.

3. In the bronchitis, or inflammatory affection of the air tubes, the membrane remaining entire, attending various diseases, e. g. the measles, a fever with a cold, various continued fevers, an expectoration of thin creamlike matter occurs, at first gradually, but at last in great quantities, continuing for a week or more. Although mucus is usually coughed up with this puriform substance, the two things generally remain in distinctly large masses. With little skill the opake or puriform fluid may be collected separately from the mucous matter. It will be found to consist almost purely of the three essential constituents of pus (Sect. VII, 1.) there being seldom any adventitious substances.

4. Muco-purulent, or commixed expectorated matter. This kind is perhaps of the most frequent occurrence. It is that which many physicians know not how to designate; some consider it to be pus, and others to be mucous matter. This contrariety of opinion arises from the want of definite notions of pus and mucus. Hence the parties are not able to perceive, that in this kind of sputum exist many of the properties of pus, and also of mucus. I have described it in my former

paper on expectorated matter, Phil. Trans. 1809, P. ii. p. 317, under the denomination of *opake ropy matter*, the third kind. I feel no degradation in finding it necessary to confess, that a better acquaintance with the properties of pus has taught me, that I was in an error, in considering this kind of expectorated matter to differ from other sorts merely in the proportion, and not in the kinds, of constituent parts. It now appears that the sputum in question possesses such properties as might be predicted to exist, from the known properties of pus and mucus separately, in case these two substances should be intimately commixed. Accordingly, the opacity; the straw colour; the greater density than mucus; the great globularity under the microscope; the greater proportion of residue on evaporation to dryness, than from mucus; the milky liquid on heating this matter; the milkiness on agitation in cold water; are properties of pus. But the great viscidity, yet not increased by neutral salts; the less opacity than pus; the less globularity than pus; the smaller proportion of exsiccated residue than from pus; the moisture, or greater moisture on the exposure of the brittle residue to air, than from that of pus; the more difficult diffusibility through cold water, and less degree of milkiness than from pus: the great proportion of leafy or fibrous masses on agitation in a very large quantity of cold water; the speedy putrescency; are properties of mucus. The mode of coagulation by caloric at 160° and upwards is such as might be expected from the commixture, viz. in large masses of curd in a milky liquid, instead of into one uniform mass like pus, or into small curdy masses in a very large proportion of a whey coloured liquid, like mucous sputum. Thick pus affords on evaporation to brittleness, $\frac{1}{7}$ or $\frac{1}{8}$ residue; and transparent sputum of the consistence of jelly, gives about $\frac{1}{18}$ or $\frac{1}{20}$ of such residue: but this opake matter under inquiry, affords $\frac{1}{16}$ or $\frac{1}{15}$ of brittle residue, according to the proportion of the two substances. I could not separate the supposed pus and mucus from one another, to exhibit them distinctly by water, or by any other means, on account, as I conceive, of the intimate diffusion through one another, and their mutual cohesion. But on evaporating the milky water, produced by agitating this sputum in it, or by letting it stand to collect the sediment, little else

besides a mere congeries of globules seen under the microscope was thus obtained. For the same reason, on standing, a serous liquid like that of pus (Sect. VII, 1.) does not separate, or only partially, from the opake part, so as to render it possible by ablution, to collect this coagulable liquid like that of pus: and the greater proportion of water, belonging to the mucus, occasions the coagulation by caloric, to afford only a milky liquid, instead of a uniform mass of curd.

This kind of sputum, consistently with the phenomena, must be produced by secretion from the bronchial membrane in its entire state, and not by ulceration or abscess. For it is secreted in many cases, at the rate of a pint or more in each twenty-four hours, for weeks and months successively, and for twenty or more successive winters. Also many persons recover their good health after this secretion, and it is the usual termination favourably of pneumonia, bronchitis, &c. It is produced by any disease of great irritation of the lungs; as I have found from ossification of the bronchial or pulmonary arteries: from calculi: from broken wind, or rupture of air cells, &c.*

It is secreted also in consequence of irritation of the bronchial membrane by tubercles, vomicæ, water in the cavities of the chest, &c. The same kind of matter is secreted from the nose on the decline of a common severe coryza in many cases. It appears then, that this kind of matter is a symptom of the most fatal, as well as harmless diseases—it is a symptom in one case of the progress of disease to death, and in another of the termination in health, by being seemingly a critical discharge. Perhaps, if these facts had been observed and considered, numerous mistakes in prognostics would have been avoided, and better practice have been employed; because the nature of diseases would have been rightly understood. From this representation it is plain, that a just opinion cannot be given merely from the examination of the sputum, without considering the disease by which it is produced, or of which it is a symptom.

* I believe this state of the lungs to have been first ascertained in broken winded horses, by Mr. Colman.

The proportion must also be considered of the pus and mucus in sputum: it may be estimated, by attending to the properties of each, as above stated.

Such a compound as the present scarcely is produced in any other part, but in the bronchial and mucous membrane of the nose, because of the abundant secretion of mucus from these membranes. And when it is conceived, that both pus and mucus are secreted in a limpid state, from the same or at least contiguous organs, where they first intimately commix, and then become inspissated; it will appear reasonable, that they cannot be readily, or at all completely separated again from one another. There is indeed, in these cases no necessity for the admission of the secretion of the limpid fluid of pus of abscesses (Sect. VII. 1.); for it appears to me not unjust to consider mucus to be nothing more than the serum of blood, altered in its composition and proportion of water, so as to produce a viscid texture. The secretory organs of the mucous membrane, by virtue of their peculiar power, separate from the blood, in health, the mucus as above said, with some globules, and also a small proportion of the self-coagulable lymph; which appears, on agitating mucus in a large proportion of cold water, in the form of leafy and fibrous masses.* The same secretory organs, it is easily conceivable, may, in a diseased state, be excited to separate also self-coagulable matter from the blood, with more globules, in such a state as to become pus. Hence, such a commixture of the two substances must correspond to the opake, viscid, expectorated sputum, of which I am writing.

If I thought farther reasoning proper, it would be manifest, that all the phenomena, both in health and disease, belonging to the various kinds of sputum, consist with the theory above delivered.

* Serum of blood appears always to contain self-coagulable lymph, which is deposited on standing; and this appearance led Gaber, Pringle, and Cullen, into the erroneous opinion of this deposit being pus itself.

Experiments and Observations on the different Modes in which Death is produced by certain vegetable Poisons. By B. C. Brodie, Esq. F. R. S. Communicated by the Society for promoting the Knowledge of Animal Chemistry.

[From the Philosophical Magazine for August 1811.]

1. The following experiments were instituted with a view to ascertain, in what manner certain substances act on the animal system, so as to occasion death, independently of mechanical injury. I was led to the inquiry, from the subject of it appearing to be of considerable interest and importance, and from a hope, that, in the present improved state of physiological knowledge, we might be enabled to arrive at some more satisfactory conclusions than had been deduced from any former observations.

The substances which act as poisons when applied to the animal body are very numerous. In the experiments which I have hitherto made, I have employed vegetable poisons only. Of these I have selected such as are very active and certain in producing their effects, believing that, on this account, the exact nature of those effects would be more readily ascertained. The principal objects which I have kept in view have been to determine, on which of the vital organs the poison employed exercises its primary influence, and through what medium that organ becomes affected. I have also endeavoured to ascertain by what means the fatal consequences of some poisons may be prevented. With some of the conclusions which I have ventured to draw, so far as I know, we were not before acquainted; and others of them, though not entirely new, had not been previously established by satisfactory experiments.

I shall relate first those experiments in which poisons were applied internally, that is, to the mucous membranes of the tongue or alimentary canal, and afterwards those in which poisons were applied to wounded surfaces.

II. *Experiments with Poisons applied to the Tongue or alimentary Canal.*

Experiments with Alcohol.

When spirits are taken into the stomach, in a certain quantity, they produce that kind of delirium which constitutes intoxication: when taken in a larger quantity, it is well known that they destroy life altogether, and that in the course of a very short space of time. Intoxication is a derangement of the functions of the mind, and, as these are in some way connected with those of the brain, it seems probable, that it is by acting on this organ, that spirits when taken into the stomach occasion death. In order to ascertain how far this conclusion is just, I made the following experiments.*

Experiment 1. I poured two drachms of proof spirits down the œsophagus of a cat. Instantly he struggled violently; then lay on one side, perfectly motionless and insensible; the breathing was laboured and stertorous, and the pulsations of the heart were very frequent. He continued in this state for seven or eight minutes; then began to recover; the respirations became easier, and presently he stood up, and was able to walk.

Experiment 2. I injected an ounce and a half of proof spirits into the stomach of a large full-grown rabbit, by means of an elastic gum tube passed down the œsophagus. The same symptoms took place as in the last experiment; but the animal did not begin to recover from the state of insensibility until forty minutes had elapsed from the time of the injection.

Experiment 3. Seven drachms of proof spirits were injected into the stomach of a younger rabbit. Two minutes afterwards, he evidently was affected by the spirits, and in three minutes more he lay on one side motionless and insensible. The pupils of the eyes were perfectly dilated; there were occasional slight convulsive motions of the extremities; the respira-

* I am indebted to Dr. E. N. Bancroft for his assistance in many of the experiments which I am about to detail. Mr. W. Brande lent me his assistance in the greater part of those which were made. I have been farther assisted by Mr. Broughton, Mr. R. Rawlins, and Mr. R. Gatcombe, and by several other gentlemen.

tion was laborious, it was gradually performed at longer and longer intervals, and at the end of an hour and fifteen minutes had entirely ceased. Two minutes after the animal was apparently dead, I opened into the thorax, and found the heart acting with moderate force and frequency, circulating dark-coloured blood. I introduced a tube into the trachea, and produced artificial respiration by inflating the lungs, and found that by these means the action of the heart might be kept up to the natural standard, as in an animal from whom the head is removed.

Experiment 4. I injected into the stomach of a rabbit two ounces of proof spirits. The injection was scarcely completed, when the animal became perfectly insensible. Precisely the same symptoms took place as in the last experiment, and at the end of twenty-seven minutes, from the time of the injection, the rabbit was apparently dead; but on examining the thorax the heart was found still acting, as in the last experiment.

It has been shown by M. Bichat, and the observation has been confirmed by some experiments which I have lately had the honour of communicating to this learned Society, that the brain is not directly necessary to the action of the heart, and that, when the functions of the brain are destroyed, the heart continues to contract for some time afterwards, and then ceases only in consequence of the suspension of respiration, which is under the influence of the brain.

It would appear, from the experiments which I have just detailed, that the symptoms produced by a large quantity of spirits taken into the stomach, arise entirely from disturbance of the functions of the brain. The complete insensibility to external impressions; the dilatation of the pupils of the eyes; and the loss of motion, indicate that the functions of this organ are suspended; respiration, which is under its influence, is ill performed, and at last altogether ceases; while the heart, to the action of which the brain is not directly necessary, continues to contract, circulating dark-coloured blood for some time afterwards.

There is a striking analogy between the symptoms arising from spirits taken internally, and those produced by injuries of the brain.

Concussion of the brain, which may be considered as the slightest degree of injury, occasions a state of mind resembling intoxication, and the resemblance in some instances is so complete, that the most accurate observer cannot form a diagnosis, except from the history of the case. Pressure on the brain, which is a more severe injury than concussion, produces loss of motion, insensibility, dilatation of the pupils; respiration becomes laboured and stertorous, is performed at long intervals, and at last altogether ceases, and the patient dies.

It forms an interesting matter of inquiry, whether spirits when taken into the stomach produce their effects on the brain, by being absorbed into the circulation, or in consequence of the sympathy that exists between these organs by means of the nerves. The following circumstances lead me to conclude that they act in the last of these two ways.

1. In experiments where animals have been killed by the injection of spirits into the stomach, I have found this organ to bear the marks of great inflammation, but never found any preternatural appearances whatever in the brain. 2. The effects of spirits taken into the stomach in the last experiment were so instantaneous, that it appears impossible that absorption should have taken place before they were produced. 3. A person who is intoxicated, frequently becomes suddenly sober after vomiting. 4. In the experiments which I have just related, I mixed tincture of rhubarb with the spirits, knowing from the experiments of Mr. Home, and Mr. William Brande, that this, when absorbed into the circulation, was readily separated from the blood by the kidneys, and that very small quantities might be detected in the urine by the addition of potash; but, though I never failed to find urine in the bladder, I never detected rhubarb in it.

The including the termination of the thoracic duct in a ligature does not prevent spirits, when taken into the stomach, from producing their usual effects on the nervous system; but subsequent observations, which Mr. Home has already communicated to this Society, have shown that no conclusion can be drawn from this experiment.

That a poison may affect a distant organ, through the medium of the nerves, without entering the circulation, is proven by

the well-known circumstance of solution of the extract of *belladonna*, when applied to the tunica conjunctiva of the eye, occasioning dilatation of the pupil of the same eye, though no other part of the system is affected.

It has been formerly supposed by Dr. Mead and other physiologists, that a poison may produce death by acting on the extremities of the nerves of the stomach and intestines, without being absorbed into the circulation. That it should by these means be capable of affecting the brain is not to be wondered at, when we consider the numerous and various sympathies between this organ and the alimentary canal, evidently independent of any other communication than the nerves.

*Experiments with the Essential Oil of Bitter Almonds.**

EXPERIMENT 5. One drop of the essential oil of bitter almonds was applied to the tongue of a young cat. She was instantly seized with violent convulsions; then lay on one side motionless, insensible, breathing in a hurried manner; the respirations became laboured, took place at longer and longer intervals, and at the end of five minutes, from the application of the poison, had entirely ceased, and the animal was apparently dead; but, on opening the thorax, the heart was found acting regularly eighty times in a minute, circulating dark-coloured blood, and it continued to act for six or seven minutes afterwards.

EXPERIMENT 6. I injected into the rectum of a cat half an ounce of water, with two drops of the essential oil. In two minutes afterwards, he was affected with symptoms similar to those which occurred in the last experiment, and at the end of five minutes, from the injection of the poison, he was apparently dead. Two minutes after apparent death, the heart was found acting eighty times in a minute. On dissection, no preternatural appearances were found either in the internal membrane of the rectum, or the brain.

* The essential oil of bitter almonds does not appear to differ from the essential oil of laurel. I was furnished with a quantity of it, first by my friend Mr. William Brande, and afterwards by Mr. Cooke of Southampton street.

The symptoms produced by this poison, and the circumstance of the heart continuing to contract after apparent death, lead to the conclusion that it occasions death by disturbing the functions of the brain.

While engaged in these last experiments, I dipped the blunt end of a probe into the essential oil, and applied it to my tongue, meaning to taste it, and having no suspicion that so small a quantity could produce any of its specific effects on the nervous system; but scarcely had I applied it, when I experienced a very remarkable and unpleasant sensation, which I referred chiefly to the epigastric region, but the exact nature of which I cannot describe, because I know nothing precisely similar to it. At the same time there was a sense of weakness in my limbs, as if I had not the command of my muscles, and I thought that I was about to fall. However, these sensations were momentary, and I experienced no inconvenience whatever afterwards.

I afterwards applied a more minute quantity of the essential oil to my tongue several times, without experiencing from it any disagreeable effects; but on applying a larger quantity, I was affected with the same momentary sensations as in the former instance, and there was a recurrence of them in three or four seconds after the first attack had subsided.

From the instantaneousness with which the effects are produced, and from its acting more speedily when applied to the tongue than when injected into the intestine, though the latter presents a better absorbing surface, we may conclude that this poison acts on the brain through the medium of the nerves, without being absorbed into the circulation.

Experiment with the Juice of the Leaves of Aconite.

Experiment 7. An ounce of this juice was injected into the rectum of a cat. Three minutes afterwards he voided what appeared to be nearly the whole of the injection; he then stood for some minutes perfectly motionless, with his legs drawn together; at the end of nine minutes, from the time of the injection, he retched and vomited; then attempted to walk, but faltered and fell at every step, as if from giddiness. At the end of thirteen minutes, he lay on one side insensible,

motionless, except some slight convulsive motions of the limbs. The respiration became slow and laboured; and at forty-seven minutes from the time of the injection, he was apparently dead. One minute and a half afterwards, the heart was found contracting regularly one hundred times in a minute.

It appears from this experiment, that the juice of aconite, when injected into the intestine, occasions death by destroying the functions of the brain. From the analogy of other poisons, it is rendered probable that it acts on the brain through the medium of the nerves, without being absorbed into the circulation. This opinion is confirmed by the following circumstance: if a small quantity of the leaf of aconite is chewed, it occasions a remarkable sense of numbness of the lips and gums, which does not subside for two or three hours.

Experiments with the Infusion of Tobacco.

EXPERIMENT 8. Four ounces of infusion of tobacco were injected into the rectum of a dog. Four minutes afterwards he retched, but did not vomit; he then became faint, and lay motionless on one side; at the end of nine minutes from the time of the injection, the heart could not be felt; he gasped for breath at long intervals; and in another minute there was no appearance whatever of life. I immediately laid open the cavities of the thorax and abdomen. The heart was much distended, and had entirely ceased to contract; there was no peristaltic motion of the intestines.

EXPERIMENT 9. An ounce of very strong infusion of tobacco was injected into the rectum of a cat. Symptoms were produced similar to those which occurred in the last experiment, and the animal died at the end of seven minutes from the time of the injection. On opening the thorax immediately after death, the heart was found extremely distended, and to have entirely ceased acting, with the exception of a slight tremulous motion of the auricles.

EXPERIMENT 10. Three ounces of infusion of tobacco were injected into the rectum of a dog. He was affected with symptoms similar to those in the former experiments, and died at the end of ten minutes. On opening the thorax immediately

after death, I found the heart much distended, and to have entirely ceased contracting.

Experiment 11. Three ounces of infusion of tobacco were injected into the rectum of a dog. Immediately there took place tremulous contractions of the voluntary muscles. Five minutes afterwards the injection was repeated in the same quantity. The dog then was sick, and threw up some of the infusion, with other matter, from the stomach; he became faint, and died ten minutes after the second injection. Immediately after respiration had ceased, I opened the thorax, and found the heart extremely distended, and without any evident contraction, except of the appendix of the right auricle, which every now and then contracted in a slight degree. I divided the pericardium on the right side. In consequence of the extreme distention of the heart, this could not be done without irritating the fibres with the point of the scalpel. Immediately both auricles and ventricles began to contract with considerable force, so as to restore the circulation. Artificial respiration was produced, and the circulation was kept up for more than half an hour, beyond which time the experiment was not continued.

We may conclude from these experiments, that the effect of the infusion of tobacco, when injected into the intestine of a living animal, is to destroy the action of the heart, stopping the circulation and producing syncope. It appeared to me that the action of the heart ceased even before the animal had ceased to respire; and this was confirmed by another experiment, in which, in a dog killed by the infusion of tobacco, I found the cavities of the left side of the heart to contain scarlet blood, while in those of the right side the blood was dark-coloured. This poison therefore differs materially from alcohol, the essential oil of almonds, and the juice of aconite, which have no direct influence on the action of the heart. The infusion of tobacco renders the heart insensible to the stimulus of the blood, but it does not altogether destroy the power of muscular contraction, since the heart resumed its action in one instance on the division of the pericardium, and I have found that the voluntary muscles of an animal killed by this poison, are as readily stimulated to contract by the influence of the voltaic battery, as if it had been killed in any other manner.

At the same time, however, that the infusion of tobacco destroys the action of the heart, it appears to destroy also the functions of the brain, since these did not return in the last experiment; although the circulation was restored, and kept up by artificial respiration.

Since there is no direct communication between the intestinal canal and the heart, I was at first induced to suppose that the latter becomes affected in consequence of the infusion being conveyed into the blood by absorption. Some circumstances in the following experiment have since led me to doubt whether this is the case.

Experiment 12. In a dog, whose head was removed, I kept up the circulation by means of artificial respiration, in the manner already described in the account of some experiments which I lately communicated to this society. I then injected into the stomach and intestines nine ounces of infusion of tobacco. At the time of the injection, the body of the animal lay perfectly quiet and motionless on the table; the heart acted regularly one hundred times in a minute. Ten minutes afterwards the pulse rose to one hundred and forty in a minute; the peristaltic motion of the intestines was much increased, and the voluntary muscles in every part of the body were thrown into repeated and violent spasmodic action. The joints of the extremities were alternately bent and extended; the muscles of the spine, abdomen, and tail alternately relaxed and contracted, so as to turn the whole animal from one side to the other. I have observed, in other instances, spasmodic actions of the muscles, where the circulation was kept up by artificial respiration, after the removal of the head, but not at all to be compared, either in strength or frequency, with those which took place on this occasion. I made pressure on the abdominal aorta for more than a minute, so as to obstruct the circulation of the blood in the lower extremities; but the muscular contractions were not lessened in consequence. Half an hour after the injection of the infusion, the artificial respiration was discontinued. The heart continued to act, circulating dark-coloured blood; the muscular contractions continued, but gradually diminished in strength and frequency. I tied a ligature round the vessels at the base of the heart, so as to stop the cir-

culation; nevertheless, the muscular contractions still continued, though less frequent and forcible than before, and some minutes elapsed before they entirely ceased.

In this experiment, the disposition to contraction in the muscles was very much increased, instead of being diminished, as in those just related. If the infusion of tobacco influences the heart, from being absorbed into the blood and thus coming into actual contact with its fibres, there is no evident reason why the removal of the brain, and the employment of artificial respiration, should occasion so material a difference in its effects. If the contractions of the voluntary muscles had depended on the infusion circulating with the blood, it is reasonable to suppose that the pressure on the aorta would have occasioned some diminution of them, and that the complete obstruction of the circulation would have caused them to cease altogether.

From these considerations, I am induced, on the whole, to believe that the infusion of tobacco, when injected into the intestines, influences the heart through the medium of the nervous system; but I have not been able to devise any experiment, by which the truth or fallacy of this opinion might be put beyond the reach of doubt.

It appears remarkable, that the brain and nervous system, although not necessary to the action of the heart, should, when under the influence of the infusion of tobacco, be capable of influencing this organ so as to stop its action; but this is analogous to what we see occur in consequence of violent emotions of the mind. Those states of the nervous system, which accompany the passions of joy, fear, or anger, when existing in a moderate degree, render the heart more sensible to the stimulus of the blood, and increase the frequency of its contractions; while, when the same passions exist in a greater degree, the heart is rendered altogether insensible to the stimulus of the blood, and syncope ensues.

*Experiments with the Empyreumatic Oil of Tobacco.**

EXPERIMENT 13. Less than a drop of this oil was applied

* I was furnished with the empyreumatic oil of tobacco by Mr. W. Brande. It may be procured by subjecting the leaves of tobacco to distillation in a

to the tongue of a young cat. Instantly violent convulsions took place in all the muscles, and the respirations became very frequent. In five minutes after the application, she lay on one side insensible, with slight spasmodic actions of the muscles. At the end of eleven minutes she retched, but did not vomit. In a quarter of an hour she appeared to be recovering. I repeated the application of the poison, and she was again seized with violent convulsions, and became insensible, breathing at long intervals; and in two minutes from the second application respiration had entirely ceased, and she was apparently dead. On opening the thorax, I found the heart acting with regularity and strength, circulating dark-coloured blood. I introduced a tube into the trachea, and produced artificial respiration; the contractions of the heart became augmented in force and frequency, and there was no evident diminution in six or seven minutes, during which the artificial respiration was continued.

On dissection, nothing remarkable was found in the appearance of the tongue or brain.

The symptoms and mode of death, in this experiment, did not essentially differ from those produced by the essential oil of almonds. I was surprised to find the effects of the empyreumatic oil so entirely different from those of the infusion of tobacco. Supposing that this difference might arise from the poison being more concentrated in the oil than in the infusion, I made the following experiments.

Experiment 14. A drop of the oil of tobacco was suspended in an ounce and a half of water by means of mucilage of gum arabic, and the whole was injected into the rectum of a dog. In two minutes afterwards he became faint, retched, but did not vomit. He appeared to be recovering from this state, and in twenty-five minutes after the first injection, it was repeated in the same quantity. He was then seized with symptoms similar to those in the last experiment, and in two minutes and a half he was apparently dead.

Two minutes after apparent death, on the thorax being opened into, the heart was found acting regularly one hundred times in a minute, and it continued acting for several minutes.

heat above that of boiling water: a quantity of watery fluid comes over, on the surface of which is a thin film of unctuous substance.

EXPERIMENT 15. A drop of the empyreumatic oil of tobacco with an ounce of water was injected into the rectum of a cat. The symptoms produced were in essential circumstances similar to those which occurred in the last experiment. The animal was apparently dead in five minutes after the injection, and the heart continued to contract for several minutes afterwards.

We may conclude from these experiments, that the empyreumatic oil of tobacco, whether applied to the tongue or injected into the intestine, does not stop the action of the heart and induce syncope, like the infusion of tobacco; but that it occasions death by destroying the functions of the brain, without directly acting on the circulation. In other words, its effects are similar to those of alcohol, the juice of aconite, and the essential oil of almonds.

III. *Experiments with Poisons applied to wounded Surfaces.*

Experiments with the Essential Oil of Almonds.

EXPERIMENT 16. I made an incision in the thigh of a rabbit, and introduced two drops of essential oil between the skin and the muscles. In four minutes after the application, he was seized with violent convulsions, and became insensible, and in two minutes more he was apparently dead; but the heart was felt through the ribs acting one hundred and twenty times in a minute, and it continued acting for several minutes. There were no other appearances in the limb, than would have resulted from an ordinary wound.

EXPERIMENT 17. Two drops of the essential oil of almonds were introduced into a wound in the side of a mouse. Two minutes afterwards he was affected with symptoms similar to those which occurred in the last experiment, and in two minutes more he was apparently dead, but the heart continued to contract for some minutes afterwards.

From the experiments which I have just related, and from others which it appears unnecessary to detail, as the general results were the same, I have learned that where the essential oil of almonds is applied to a wound, its effects are not so instantaneous as when it is applied to the tongue; otherwise

there is no difference in its effects, in whatever manner it is applied.

Experiments with the Juice of the Leaves of Aconite.

EXPERIMENT 18. I made a wound in the side of a young rabbit, and introduced, between the skin and muscles, about twenty drops of the juice of aconite. Twenty-three minutes afterwards he was affected with symptoms in all essential respects similar to those which occurred in an experiment already related, where the juice was injected into the rectum, and at the end of forty-seven minutes from the application of the poison he was apparently dead. Two minutes after apparent death, the heart was found contracting, but very feebly.

*Experiments with the Woorara.**

EXPERIMENT 19. A small quantity of the woorara in powder was applied to a wound in the side of a Guinea pig. Ten minutes afterwards the animal was unable to walk; then he became quite motionless, except some slight occasional convulsions. He gradually became insensible; the respirations were laboured, and at the end of fourteen minutes from the application of the poison the respiration had entirely ceased, and he was apparently dead; but on opening the thorax, the heart was found acting seventy times in a minute, circulating dark-coloured blood, and it continued to contract for several minutes afterwards. On dissection, no preternatural appearances were observed in the brain, nor was there any other appearance in the limb than would have arisen from an ordinary wound.

EXPERIMENT 20. I made a wound in the side of a Guinea pig, and introduced into it about two grains of the woorara in powder. At the end of twenty-five minutes, symptoms took place very similar to those which occurred in the last experiment, and in thirteen minutes more the animal was apparently dead; but the heart continued to contract one hundred and

* The Woorara is a poison with which the Indians of Guyana arm the points of their arrows. It appears not to differ essentially from the Ticunas, which was employed in the experiments of the Abbé Fontana. I am indebted to Dr. E. N. Bancroft, who not only furnished me with some of the woorara which he had in his possession, but also lent me his assistance in the experiments which were made with it.

eight times in a minute, and by means of artificial respiration the circulation was kept up for more than twenty minutes.

The results of other experiments which I have made with the woorara were similar to those just described. The heart continued to act after apparent death, and the circulation might be kept up by means of artificial respiration. It is evident that this poison acts in some way or other on the brain, and that the cessation of the functions of this organ is the immediate cause of death.

I found in these experiments, that the best mode of applying the woorara is when it is dissolved in water to the consistence of a thin paste. I first made the wound, and then smeared the poison over it with the end of the scalpel. I found that the animal was more speedily and certainly affected, if there was some hemorrhage, unless the hemorrhage was very copious, when it produced an opposite effect, by washing the poison away from the wound. When the poison was applied in large quantity, it sometimes began to act in six or seven minutes. Never more than half an hour elapsed from the time of the poison being inserted, to that of the animal being affected, except in one instance, where a ligature was applied on the limb, which will be mentioned afterwards. The woorara, which I employed, had been preserved for some years, which will account for its having been less active than it has been described to be by those who had witnessed its effects when in a recent state.

*Experiments with the Upas Antiar.**

EXPERIMENT 21. About two grains of this poison were made into a thin paste with water, and inserted into a wound in the thigh of a dog. Twelve minutes afterwards he became languid; at the end of fifteen minutes, the heart was found to beat very irregularly, and with frequent intermissions; after this, he had a slight rigor. At the end of twenty minutes, the heart

* We are informed that the island of Java produces two powerful vegetable poisons, to one of which the natives give the name of *Upas tieutè*, and to the other that of *Upas antiar*. I was supplied with a quantity of the latter through the kindness of Mr. Marsden, who had some of it in his possession.

beat very feebly and irregularly; he was languid; was sick and vomited; but the respirations were as frequent and as full as under natural circumstances, and he was perfectly sensible. At the end of twenty minutes he suddenly fell on one side, and was apparently dead. I immediately opened into the thorax, and found the heart distended with blood in a very remarkable degree, and to have entirely ceased contracting. There was one distinct and full inspiration after I had begun making the incision into the thorax. The cavities of the left side of the heart contained scarlet blood, and those of the right side contained dark-coloured blood, as in a living animal.

Experiment. 22. A small quantity of the upas antiar, prepared as before, was inserted into a wound in the thigh of a young cat. She appeared languid in two minutes after the poison was inserted. The symptoms which took place did not essentially differ from those which occurred in the last experiment, except that there were some convulsive motions of the limbs. At eight minutes after the poison was inserted, she lay on one side motionless and insensible, the heart could not be felt, but the respiration had not entirely ceased. On opening into the thorax, I found the heart to have ceased contracting. It was much distended with blood: and the blood in the cavities of the left side was of a scarlet colour. There were two full inspirations after the incision of the thorax was begun. On irritating the heart with the point of the scalpel, slight contractions took place in the fibres of the appendices of the auricles, but none in any other part.

Experiment 23. The experiment was repeated on a rabbit. The symptoms produced were similar to those in the last experiment; but the animal did not vomit, and the convulsive motions were in a less degree: he died eleven minutes after the poison was inserted. On opening the chest, the heart was found to have entirely ceased contracting; it was much distended with blood; and the blood in the cavities of the left side was of a scarlet colour. On irritating the heart with the point of the scalpel, the ventricles contracted, but not sufficiently to restore the circulation.

Experiment 24. About a grain of the upas antiar was inserted into a wound in the side of a rabbit. He was affected

with symptoms similar to those before described, and died in ten minutes after the poison was applied. On opening the thorax immediately after death, the heart was found to have ceased contracting, and the blood in the cavities of the left side was of a scarlet colour.

It appears from these experiments, that the upas antiar, when inserted into a wound, produces death (as infusion of tobacco does when injected into the intestines) by rendering the heart insensible to the stimulus of the blood, and stopping the circulation. The heart beats feebly and irregularly before either the functions of the mind or the respiration appear to be affected. Respiration is performed even after the circulation has ceased; and the left side of the heart is found after death to contain scarlet blood, which never can be the case where the cause of death is the cessation of the functions of the brain or lungs. The convulsions which occur when the circulation has nearly ceased, probably arise from the diminution of the supply of blood to the brain, resembling those which take place in a person who is dying from hemorrhage.

There remains an interesting subject of inquiry, "through what medium do poisons influence the brain when applied to wounds?" That poisons applied in this manner do not produce their effects precisely in the same way as poisons taken internally, is rendered probable by this circumstance; that some poisons, which are very powerful when applied to wounds even in small quantities, are either altogether inefficient when taken internally, or require to be given in very large quantities, in order to produce their effect, and *vice versâ*.

A poison applied to a wounded surface may be supposed to act on the brain in one of three ways,

1. By means of the nerves, like poisons taken internally.

2. By passing into the circulation through the absorbent vessels.

3. By passing directly into the circulation through the divided veins.

EXPERIMENT 25. In order to ascertain whether the woorara acts through the medium of the nerves, I exposed the axilla of a rabbit, and divided the spinal nerves supplying the upper extremity, just before they unite to form the axillary plexus.

The operation was performed with the greatest care. I not only divided every nervous filament, however small, which I could detect, but every portion of cellular membrane in the axilla, so that the artery and vein were left entirely insulated. I then made two wounds in the fore-arm, and inserted into them some of the woorara formed into a paste. Fourteen minutes after the poison was applied, the hind legs became paralytic, and in ten minutes more he died, with symptoms precisely similar to those which took place in the former experiments, and the heart continued to act after apparent death. On dissection, the nerves of the upper extremity were particularly examined, but not the smallest filament could be found undivided.

I made the following experiment, to ascertain whether the woorara passes into the circulation through the absorbent vessels.

Experiment 26. I tied a ligature round the thoracic duct of a dog, just before it perforates the angle of the left subclavian and jugular veins. I then made two wounds in the left hind leg, and introduced some of the woorara in powder into them. In less than a quarter of an hour he became affected with the usual symptoms, and died in a few minutes afterwards.

After death, I dissected the thoracic duct with great care. I found it to have been perfectly secured by the ligature. It was very much distended with chyle; and about two inches below its termination its coats had given way, and chyle was extravasated into the cellular membrane. The lymphatic vessels in the left axilla were distended in a very remarkable degree; and on dividing them, not less than a drachm of lymph issued from the divided ends.

Since neither the division of the nerves nor the obstruction of the thoracic duct interfere in the slightest degree with the effects of the woorara, there is presumptive evidence that it acts on the brain by entering the circulation through the divided veins. I endeavoured to ascertain, by experiment, whether this is really the case.

To apply ligatures to the large vessels of a limb only would evidently lead to no satisfactory conclusion, since the anastomosing vessels might still carry on the circulation. The only

way which I could devise of performing the experiment, was to include all the vessels, small as well as large, in a ligature.

Experiment 27. In order to make the experiment more satisfactorily, I exposed the sciatic nerve of a rabbit in the upper and posterior part of the thigh, and passed under it a tape half an inch wide. I then made a wound in the leg, and having introduced into it some of the woorara mixed with water, I tied the tape moderately tight on the forepart of the thigh. Thus I interrupted the communication between the wounds and the other parts of the body, by means of the vessels, while that by means of the nerve still remained. After the ligature was tightened, I applied the woorara a second time, in another part of the leg. The rabbit was not at all affected, and at the end of an hour I removed the ligature. Being engaged in some other pursuit, I did not watch the animal so closely as I should otherwise have done; but twenty minutes after the ligature was removed, I found him lying on one side, motionless and insensible, evidently under the influence of the poison; but the symptoms were less violent than in most instances, and after lying in this state he recovered, and the limb became perfectly warm, and he regained the power of using it.

Experiment 28. I repeated the last experiment with this difference, that after having applied the poison, I made the ligature as tight as I could draw it. I removed the ligature at the end of an hour and twenty minutes, but the animal was not at all affected either before or after the removal of the ligature, and on the following day he had recovered the use of the limb.

Experiment 29. I repeated the experiment a third time, drawing the ligature very tight. At the end of forty-five minutes the animal continued perfectly well, and the ligature was removed. I watched him for three quarters of an hour afterwards, but there were no symptoms of his being affected by the poison. On the following day the rabbit died; but this I attribute to the injury done to the limb and sciatic nerve by the ligature, as there was the appearance of inflammation in the parts in the neighbourhood of the ligature.

These three experiments were made with the greatest care. From the mode in which the poison was applied, from the quantity employed, and from my prior experience, I should

have entertained not the smallest doubt of the poison taking effect in every instance in less than twenty minutes, if no ligature had been applied. In two of the three, the quantity of woorara was more than had been used in any former experiments.

I have not judged it necessary to make any more experiments, with the ligature on the limb, because the numerous experiments of the Abbé Fontana on the ticunas, coincide in their results with those which have just been detailed, and fully establish the efficacy of the ligature in preventing the action of the poison. It is not to be wondered at, that the ligature should sometimes fail in its effects, since these must evidently depend on the degree in which the circulation is obstructed, and on the length of time during which the obstruction is continued.

There can be little doubt that the woorara affects the brain, by passing into the circulation through the divided vessels. It is probable that it does not produce its effects, until it enters the substance of the brain, along with the blood, in which it is dissolved; nor will the experiments of the Abbé Fontana, in which he found the ticunas produce almost instant death when injected into the jugular vein of a rabbit, be found to militate against this conclusion, when we consider how short is the distance which, in so small an animal, the blood has to pass from the jugular vein to the carotid artery, and the great rapidity of the circulation; since in a rabbit under the influence of terror, during such an experiment, the heart cannot be supposed to act so seldom as three times in a second.

I have made no experiments to ascertain through what medium other poisons when applied to wounds affect the vital organs, but from analogy we may suppose that they enter the circulation through the divided bloodvessels.

IV.

The facts already related led me to conclude that alcohol, the essential oil of almonds, the juice of aconite, the oil of tobacco, and the woorara, occasion death simply by destroying the functions of the brain. The following experiment appears fully to establish the truth of this conclusion.

EXPERIMENT 30. The temperature of the room being 58° of Fahrenheit's thermometer, I made two wounds in the side of a rabbit, and applied to them some of the woorara in the form of paste. In seven minutes after the application, the hind legs were paralized, and in fifteen minutes respiration had ceased, and he was apparently dead. Two minutes afterwards the heart was still beating, and a tube was introduced through an opening into the trachea, by means of which the lungs were inflated. The artificial respiration was made regularly about thirty-six times in a minute.

At first, the heart contracted one hundred times in a minute.

At the end of forty minutes, the pulse had risen to one hundred and twenty in a minute.

At the end of an hour, it had risen to one hundred and forty in a minute.

At the end of an hour and twenty-three minutes, the pulse had fallen to a hundred, and the artificial respiration was discontinued.

At the commencement of the experiment, the ball of a thermometer being placed in the rectum, the quicksilver rose to one hundred degrees; at the close of the experiment it had fallen to eighty-eight and a half.

During the continuance of the artificial respiration, the blood in the femoral artery was of a florid red, and that in the femoral vein of a dark colour, as usual.

It has been observed by M. Bichat, that the immediate cause of death, when it takes place suddenly, must be the cessation of the functions of the heart, the brain, or the lungs. This observation may be extended to death under all circumstances. The stomach, the liver, the kidneys, and many other organs are necessary to life, but their constant action is not necessary; and the cessation of their functions cannot therefore be the *immediate* cause of death. As in this case the action of the heart had never ceased; as the circulation of the blood was kept up by artificial respiration for more than an hour and twenty minutes after the poison had produced its full effects; and as during this time the usual changes in the colour of the blood took place in the lungs; it is evident that the functions of the heart and lungs were unimpaired: but that those of the

brain had ceased, is proved by the animal having continued in a state of complete insensibility; and by this circumstance, that animal heat, to the generation of which I have formerly shown the influence of the brain to be necessary, was not generated.

Having learned that the circulation might be kept up by artificial respiration for a considerable time after the woorara had produced its full effects, it occurred to me that in an animal under the influence of this or of any other poison that acts in a similar manner, by continuing the artificial respiration for a sufficient length of time after natural respiration had ceased, the brain might recover from the impression which the poison had produced, and the animal might be restored to life. In the last experiment, the animal gave no sign of returning sensibility; but it is to be observed, 1. That the quantity of the poison employed was very large. 2. That there was a great loss of animal heat, in consequence of the temperature of the room being much below the natural temperature of the animal, which could not therefore be considered under such favourable circumstances as to recovery, as if it had been kept in a higher temperature. 3. That the circulation was still vigorous when I left off inflating the lungs, and therefore it cannot be known what would have been the result, if the artificial respiration had been longer continued.

Experiment 31. A wound was made in the side of a rabbit, and one drop of the essential oil of almonds was inserted into it, and immediately the animal was placed in a temperature of 90°. In two minutes he was under the influence of the poison. The usual symptoms took place, and in three minutes more respiration had ceased, and he lay apparently dead, but the heart was still felt beating through the ribs. A tube was then introduced into one of the nostrils, and the lungs were inflated about thirty-five times in a minute. Six minutes after the commencement of artificial respiration, he moved his head and legs, and made an effort to breathe. He then was seized with convulsions, and again lay motionless, but continued to make occasional efforts to breathe. Sixteen minutes after its commencement, the artificial respiration was discontinued. He now breathed spontaneously seventy times in a minute, and moved his head and extremities. After this, he occasionally

rose, and attempted to walk. In the intervals he continued in a dozing state; but from this he gradually recovered. In less than two hours he appeared perfectly well, and he continued well on the following day.

The inflating the lungs has been frequently recommended in cases of suffocation, where the cause of death is the cessation of the functions of the lungs: as far as I know, it has not been before proposed in those cases, in which the cause of death is the cessation of the functions of the brain.* It is probable that this method of treatment might be employed with advantage for the recovery of persons labouring under the effects of opium, and many other poisons.

V.

The experiments which have been detailed lead to the following conclusions.

1. Alcohol, the essential oil of almonds, the juice of aconite, the empyreumatic oil of tobacco, and the woorara, act as poisons by simply destroying the functions of the brain; universal death taking place, because respiration is under the influence of the brain, and ceases when its functions are destroyed.

2. The infusion of tobacco when injected into the intestine, and the upas antiar when applied to a wound, have the power of rendering the heart insensible to the stimulus of the blood, thus stopping the circulation; in other words, they occasion syncope.

3. There is reason to believe that the poisons, which in these experiments were applied internally, produce their effects through the medium of the nerves without being absorbed into the circulation.

* Since this paper was read, I have been favoured by the right honourable the president with the perusal of a Dissertation on the Effects of the Upas Tieutè, lately published at Paris by M. Delile, by which I find that he had employed artificial respiration for the purpose of recovering animals, which were under the influence of this poison, with success. M. Delile describes the Upas Tieutè as causing death, by occasioning repeated and long-continued contractions of the muscles of respiration, on which it acts through the medium of the spinal marrow, without destroying the functions of the brain.

4. When the woorara is applied to a wound, it produces its effects on the brain, by entering the circulation through the divided bloodvessels, and, from analogy, we may conclude that other poisons, when applied to wounds, operate in a similar manner.

5. When an animal is apparently dead from the influence of a poison, which acts by simply destroying the functions of the brain, it may, in some instances at least, be made to recover, if respiration is artificially produced, and continued for a certain length of time.

From analogy we might draw some conclusions respecting the mode in which some other vegetable poisons produce their effects on the animal system; but I forbear to enter into any speculative inquiries; as it is my wish, in the present communication, to record such facts only, as appear to be established by actual experiment.

Addition to the Croonian Lecture for the year 1810.

In the experiments formerly detailed, where the circulation was maintained by means of artificial respiration after the head was removed, I observed that the blood, in its passage through the lungs, was altered from a dark to a scarlet colour, and hence I was led to conclude that the action of the air produced in it changes analogous to those which occur under ordinary circumstances. I have lately, with the assistance of my friend Mr. W. Brande, made the following experiment, which appears to confirm the truth of this conclusion.

An elastic gum bottle, having a tube and a stop-cock connected with it, was filled with about a pint of oxygen gas. The spinal marrow was divided in the neck of a young rabbit, and the bloodvessels having been secured, the head was removed, and the circulation was maintained by inflating the lungs with atmospheric air for five minutes, at the end of which time the tube of the gum bottle was inserted into the trachea, and carefully secured by a ligature, so that no air might escape. By making pressure on the gum bottle, the gas was made to pass and repass into and from the lungs about thirty times in a minute. At first, the heart acted one hundred and twenty times in a minute, with regularity and strength; the thermo-

meter, in the rectum, rose to 100°. At the end of an hour, the heart acted as frequently as before, but more feebly; the blood in the arteries was very little more florid than that in the veins; the thermometer in the rectum had fallen to 93°. The gum bottle was then removed. On causing a stream of the gas which it contained to pass through lime-water, the presence of carbonic acid was indicated by the liquid being instantly rendered turbid. The proportion of carbonic acid was not accurately determined; but it appeared to form about one half of the quantity of gas in the bottle.

B. C. BRODIE.

Report of the National Vaccine Establishment.

[From the Philosophical Magazine, for August, 1811.]

THE board of the national vaccine establishment having learned that great interest has been excited in the public mind, by the occurrence of smallpox after vaccination, in the families of the earl of Grosvenor and of sir Henry Martin, Bart. have thought it their duty to lay the following cases before the public, accompanied with some observations, and a statement how far, in their opinion, these cases affected the general advantages of vaccination.

The case of the honourable Robert Grosvenor, third son of the earl of Grosvenor, was procured through the favour of sir Henry Halford and sir Walter Farquhar, the physicians who attended the young gentleman during his illness; and the case of the son of sir Henry Martin was obtained through the favour of Dr. Heberden. Both of these cases were also visited by the director of the vaccine establishment.

I. *The Case of the Hon. Robert Grosvenor.*

On Sunday, May 26, 1811, the honourable Robert Grosvenor, who was recovering from the whooping-cough, became much indisposed, and threw up his dinner. Fever followed, and he complained most particularly of excruciating pain in his back. He dwelt on this symptom until Thursday, when he became delirious, and there were observed on his face about twenty spots.

He had been vaccinated by Dr. Jenner, in his infancy, about ten years ago, and the mark left in his arm indicated a perfect disease.

On Friday morning, the eruption had not increased materially in point of number; but the appearance of the spots, and the previous symptoms, suggested strongly a suspicion that the disorder was the smallpox.

Sir H. Halford had occasion to go to Windsor in the afternoon of Friday, and did not see Mr. Robert Grosvenor until the Monday following (June 2d); but he learned from sir W. Farquhar, who attended him most carefully during sir Henry's absence, (and subsequently), that the eruption had increased prodigiously in the course of Friday; that on the evening of that day Mr. Robert Grosvenor began to make bloody water, and that he continued to do so until Monday morning.

On the tenth day of the disease the pustules began to dry upon the face, which was swollen to a considerable degree, but not to the extent of closing his eyes, and was attended by a salivation, which lasted several days. Petechiæ had occurred in the interstices of several of the spots, particularly on the limbs, and there was that particular smell from the whole frame which is remarkable in bad cases of confluent smallpox.

It was obvious that the first symptoms of which Mr. Grosvenor complained, were such as indicated a violent disease about to follow; and sir Henry confesses that he entertained a most unfavourable opinion of the issue of such a malady, when it was fully formed; having never seen an instance of recovery under so heavy an eruption attended by such circumstances. It seemed, however, that the latter stages of the disease were passed through more rapidly in this case than usual: and it may be a question whether this extraordinary circumstance, as well as the ultimate recovery of Mr. Grosvenor, were not influenced by previous vaccination.

HENRY HALFORD,
WALTER FARQUHAR.

In addition to the preceding account, the board have authority to state, that during the illness of Mr. Grosvenor, the other

children of the earl of Grosvenor, who had been previously vaccinated, were exposed to the contagion of the smallpox under which their brother was suffering, and were also submitted to smallpox inoculation without effect.

II. *The Case of the Son of Sir Henry Martin.*

Sir Henry Martin's son, aged eleven years, was vaccinated by Mr. Tegart in the year 1801, and exhibited all the usual marks of that disorder in a complete and satisfactory manner.

He still retains on his arm the characteristic scar.

This boy was taken ill on Saturday the 22d day of June, 1811; at the period of the attack he was recovering from whooping-cough.

23d. Continued to be feverish.

24th. Mr. Tegart was sent to.

25th. The fever increased, and at night he became delirious.

26th. An eruption was perceived chiefly about the mouth, at the same time his eyes and throat were slightly inflamed. The fever continued.

27th, or 2d day of the eruption, the pustules increased, so as to afford suspicion of the chickenpox.

3d day of the eruption, the pustules increased, the fever decreased.

4th. At the close of the fourth day, Dr. Heberden first saw this boy, with a distinct eruption of the most perfect kind of smallpox, all pretty uniform in size, well filled with a fluid already beginning to grow yellow, and surrounded by a rose-coloured margin precisely like smallpox of the fifth day. There were about one hundred pustules on the face, and perhaps twice as many on the limbs, but the trunk was almost free; the features were swollen, but not very much so. The skin was hot, and the pulse quick.

5th day. The pustules were more uniform, and yellow, and the patient complained of soreness; but he was cooler, and his pulse was quieter.

6th day. The fever had entirely subsided, and the pock began to turn.

8th. The pustules were dried, and continued to fall off from the face. The boy continued quite well.

W. HEBERDEN.

Pall Mall, July 4, 1811.

With a view of obtaining the most accurate knowledge of the early symptoms of this case, which did not come under the immediate observation of Dr. Heberden, the board have procured, through the favour of Mr. Tegart, of Pall Mall, an account of the commencement and course of the disorder, which corroborates the above statement. And from the same source they have been informed, that miss Martin and a nursery maid of sir H. Martin's family, who had both been vaccinated, were inoculated with matter taken from master Martin on the fifth day of the eruption, and were exposed to the contagion of the smallpox during the course of his disorder, without effect.

The board are of opinion, that the case of the honourable Robert Grosvenor was a case of confluent smallpox. That the attack and progress of the disorder were attended by symptoms which almost invariably announce a fatal termination. But they observe, that the swelling of the face, which is generally so excessive as to close the eyes, and is considered as a favourable symptom, was slighter than usual; that on the tenth day the pustules began to dry upon the face; and that from that time the disease passed with unusual rapidity through the period when life is generally esteemed to be in the greatest hazard.

Those who are acquainted with the nature of the confluent smallpox, are aware that this peculiarity cannot be attributed to the effect of medical treatment.

The case of the son of sir Henry Martin exhibits a mild form of distinct smallpox occurring after vaccination.

In most cases of smallpox which have succeeded to vaccination, the pustules have been observed to dry more rapidly, and the disorder has concluded at an earlier period than usual.

If allowance be made for the relative periods in which the confluent and distinct smallpox complete their course, the rapid progress towards recovery through the latter stage of

confluent smallpox, as exhibited in the case of Mr. Grosvenor, may be compared with the rapid desiccation of the pustules in the distinct and peculiarly mild form of the disorder which is considered as smallpox modified by vaccination. Both forms of the disorder proceed in the usual course, the one attended with violent, the other with mild symptoms, till they arrive near to the height; when they appear to receive a check, and the recovery is unusually rapid.

From this correspondence of circumstances, the board are induced to infer that in the case of Mr. Grosvenor, which has been more violent than any yet submitted to them, the progress of the disease, through its latter stage, and the consequent abatement of symptoms, were influenced by an antivariolous effect produced upon the constitution by the vaccine process.

The occurrence of smallpox after vaccination has been foreseen and pointed out in the report on vaccination made to parliament, by the college of physicians, in the year 1807, to which the board are desirous of calling the attention of the public; wherein it is stated that,

"The security derived from vaccination against the smallpox, if not absolutely perfect, is as nearly so as can perhaps be expected from any human discovery; for amongst several hundred thousand cases, with the results of which the college have been made acquainted, the number of alleged failures has been surprisingly small, so much so as to form certainly no reasonable objection to the general adoption of vaccination; for it appears that there are not nearly so many failures in a given number of vaccinated persons, as there are deaths in an equal number of persons inoculated for the smallpox. Nothing can more clearly demonstrate the superiority of vaccination over the inoculation of the smallpox than this consideration; and it is a most important fact, which has been confirmed in the course of this inquiry, that in almost every case in which the smallpox has succeeded vaccination, whether by inoculation or by casual infection, the disease has varied much from its ordinary course; it has neither been the same in violence nor in the duration of its symptoms; but has, with very few exceptions, been remarkably mild, as if the smallpox had been de-

prived by the previous vaccine disease of its usual malignity." Vide report of the college of physicians.

The peculiarities of certain constitutions with regard to eruptive fevers, form a curious subject of medical history. Some individuals have been more than once affected with scarlet fever and measles, others have been through life exposed to the contagion of these diseases without effect; many have resisted the inoculation and contagion of smallpox for several years, and have afterwards become susceptible of the disorder, and some have been twice affected with smallpox.

Among such infinite varieties of temperament it will not appear extraordinary, that vaccination, though so generally successful, should sometimes fail of rendering the human constitution unsusceptible of smallpox, especially since it has been found that in several instances smallpox has occurred to individuals over whom the smallpox inoculation had appeared to have produced its full influence. Three instances of this kind have taken place within the last month, and in another instance the natural smallpox has occurred a second time.

I. *Case of the Rev. Joshua Rowley.*

The reverend Joshua Rowley, brother to sir W. Rowley, when an infant, was inoculated by the late Mr. Adair, 1770; the scar left by the inoculation is perfectly visible; his mother, the dowager lady Rowley, remembers perfectly his having a tolerable sprinkling of smallpox, and says, he was afterwards repeatedly exposed to variolous infection in the nursery, when his three younger brothers were successively inoculated, all of whom had some degree of eruption; and since that time, frequently, in performing the clerical duties of his profession.

On Wednesday the 5th of June, he felt much indisposed, complained of pain in his head and back, attended with considerable restlessness and prostration of strength: on Friday the 7th, an eruption appeared chiefly on his face and breast; he was attended by Mr. Woodman, of Bognor, only, till the Monday following, when Mr. Guy, surgeon, of Chichester was first consulted. On examining the eruption, Mr. Guy was immediately struck with its resemblance to the smallpox; and on gently hinting his suspicion to Mr. Rowley, received the in-

formation above related. On the following day the progress of the eruption towards maturation, and the swelling of the face, which is characteristic of the smallpox, left no doubt of the nature of the malady. The eruption was perfectly distinct; it was very full all over the trunk and body, and there were about two hundred pustules on the face. Mr. Guy is of opinion, that this was a clearly marked case of smallpox.

The history of the previous variolous inoculation in 1770, was procured from the dowager lady Rowley by Mr. Dundas, sergeant surgeon to his majesty; and the account of the present case was transmitted to the director of vaccination of this establishment, on the application of the board, by Mr. Guy, an eminent surgeon of Chichester.

II. *Case of Miss Sarah Booth, of Covent Garden Theatre.*

Dr. Bree was called to visit miss S. Booth, on Monday, June 25th. She was said to be ill with the smallpox; and the following circumstances were reported by the mother and sisters.

Miss Booth is eighteen years of age; she had been inoculated for the smallpox at five years of age, and had been affected with the usual degree of fever; the arm had been violently inflamed, and an eruption of smallpox pustules had appeared round the inoculated part, from which matter had been taken by Mr. Kennedy, the surgeon who attended her. Mr. Kennedy expressed himself satisfied that miss S. Booth had passed regularly through the disease.

The usual scar of smallpox inoculation is perfectly evident on the arm.

On Thursday, June 20th, miss Booth was seized with fever, distinguished by vomiting, violent headache, pains in the back and loins.

The symptoms continued till Saturday, June 22d, in the evening of which day some pustules came out on the forehead and scalp.

Sunday, June 23d, a more complete eruption appeared on the face and neck, and she was relieved from the violence of the fever. The vomiting however continued, the throat became very sore, and a salivation began.

Monday, June 24. The eruption extended itself on the body, the fever was still more abated, but the salivation, soreness of the throat, and vomiting, were urgent symptoms.

Tuesday, June 25th, the fourth day of the eruption. The salivation and retching continued, with soreness of throat.

Wednesday, June 26th, fifth day of the eruption. Pustules were noticed on the lower extremities, those on the face advance, and the eyes are swelled; the number of the pustules on the head and face are about two dozen.

Thursday, June 27th, sixth day of the eruption. The pustules on the face begin to turn. She still suffers from sore throat and salivation. This evening, contrary to advice, she went to her business at the theatre.

Friday, June 28th, seventh day of the eruption. The pustules on the face are turned, those on the lower extremities are few in number, but well filled, and not yet changed.

Saturday, June 29th, eighth day of the eruption. She only complains of sickness. After this day the pustules turned and dried on the lower extremities, and no complaint remained.

This case appeared to have been a very mild case of distinct smallpox.

ROBERT BREE.

This case was visited by the greater number of members of the board, and also by the director, and was attended by Mr. Hewson, of James street, Covent Garden, who entertains no doubt of this having been a case of distinct smallpox.

III. *Case of John Godwin.*

Mrs. Godwin, No. 6, Stratton street, Piccadilly, states, that she was brought to bed of this son in October, 1800; that six weeks after he was born, the smallpox prevailed very much in her neighbourhood, and one child died of it in the house in which she lived. About this time her son was attacked with very violent fever, succeeded by a copious eruption all over the face and body, which was declared by Mr. Smith, an apothecary who attended him, to be the smallpox, and which was ten or twelve days before it completely scabbed and dried off.

Some time after this, a brother of her husband, a medical

man, who had not seen the child during its illness, inoculated him for the smallpox, in order to insure his complete security; a small pimple on the part was only formed, which soon disappeared, and no fever or eruption ensued. About six weeks ago, this boy, now eleven years old, was attacked with fever, followed with an eruption, which broke out on the face, body, and limbs, exhibiting the ordinary appearance of smallpox, and which turned on the eighth day.

Mr. Kerrison, of New Burlington street, who attended this boy, states, that the eruption exhibited the exact appearance, and passed through all the stages of distinct smallpox. He also from this boy inoculated a child who had fever at the usual time, followed by a slight variolous eruption.

The history of the former disease was procured from Mrs. Godwin, and the history of the second attack of smallpox from Mr. Kerrison, by Mr. Moore, director of vaccination at this establishment.

IV. *Case of Peter Sylvester, No.* 10, *Cross street, Carnaby Market.*

This boy's parents are both dead. He was born on June 7th, 1798, and on the 21st of February following was inoculated for the smallpox by Mr. Ring, of New street, surgeon. Mr. Ring showed the director of vaccination at this establishment, his account book of that period, in which there is a charge regularly entered for inoculating this boy for the smallpox.

The cicatrix on his arm is still conspicuous, and six or seven smallpox pits, occasioned by the former eruption, have marked his face.

On the 24th of June last, this boy was taken ill with fever; on the 27th an eruption on the skin took place. Mr. Moore, the director, saw him on the 30th: the spots on the skin were very numerous, but distinct, and the skin round their bases was inflamed; many had formed within the mouth and throat.

July 1st. The eruption has now assumed the appearance of genuine smallpox, the pustules are augmenting, and the face is beginning to swell. 2d. The pustules are larger, and the face much swelled. 3d. The pustules on the face are at the height,

and the eyes are nearly closed. 4th. The pustules on the face have all begun to turn; all fever is gone.

This case is drawn up from the notes of Mr. Moore. The case was visited by several members of the board, and by many other medical gentlemen of the highest respectability.

From the period at which the violent opposition to smallpox inoculation subsided, till the establishment of vaccination, no reasonable parent has refused to allow his children the benefit of inoculation, although it has been generally acknowledged that the inoculation of the smallpox sometimes produces a fatal disease; and if at that time the instances in which the natural smallpox had occurred after inoculation, had been communicated to the public, every intelligent man would undoubtedly have still continued the same course, from a desire of affording his children the best chance of safety, although his confidence in the absolute security from natural smallpox must have been in some degree abated.

In the same manner, no effect injurious to vaccination ought to result from the knowledge of the above failures. Parents had been always apprised that there were occasional failures of vaccination, but they were always aware that none of their children would die of vaccine inoculation; and that when it failed, the succeeding smallpox was almost always much mitigated and disarmed of half its terrors. It was natural therefore, that they should choose vaccination as the less dangerous disorder, and the same reason still exists for their perseverance in that choice. If there be constitutions, which are twice susceptible of smallpox, a disorder which produces a violent action upon the human frame, and often destroys life, it is natural to expect that vaccination should not in every instance prevent the smallpox, and that the anomaly which occurs in the one disease should likewise take place in the other. It is ever to be kept in view, that the number of deaths from inoculated smallpox, exceeds the number of failures of vaccination. It appears from the present state of our information, that one person in three hundred dies from the inoculated smallpox, and that there is perhaps one failure in a thousand after vaccination. An individual, who, under such circumstances, should prefer the inoculation of his children for the

smallpox, to submitting them to vaccination, would be guilty of an improvidence similar to that of a parent who should choose for his son a military service, in which there was one chance in three hundred of being killed, in preference to a station, where there was only one chance in a thousand of being slightly wounded.

The board are of opinion, that vaccination still rests upon the basis on which it was placed by the reports of the several colleges of physicians and surgeons of the united kingdom, which were laid before parliament in the year 1807. That the general advantages of vaccination are not discredited by the instances of failure which have recently occurred, the proportion of failures still remaining less in number than the deaths which take place from the inoculated smallpox. They are led by their information to believe, that since this practice has been fully established, no death has in any instance occurred from smallpox after vaccination. That in most of the cases in which vaccination has failed, the smallpox has been a disease remarkably mild, and of unusually short duration; and they are further of opinion, that the severity of the symptoms with which Mr. Grosvenor was affected, forms an exception to a general rule.

That absolute security from the natural smallpox is not even to be attained by smallpox inoculation, is sufficiently evident from the annexed cases; and the board are enabled to state, that they have been made acquainted with instances of individuals who have twice undergone the natural smallpox.

Under all these circumstances, the board feel justified in still recommending and promoting vaccination, and in declaring their unabated confidence in this practice. Since in some peculiar frames of constitution the repetition of smallpox is neither prevented by inoculation nor casual infection, the board are of opinion, that in such peculiar constitutions the occurrence of smallpox after vaccination may be reasonably expected, and perhaps in a greater proportion; but with this admission, they do not hesitate to maintain, that the proportionate advantages of vaccination to individuals and the public, are infinitely greater than those of smallpox inoculation.

They are anxious, that the existence of certain peculiarities

of the human frame, by which some individuals are rendered by nature more or less susceptible of eruptive fevers, and of the recurrence of such disorders, should be publicly known; for they feel confident that a due consideration of these circumstances, and a just feeling of the welfare of the community, will induce the public to prefer a mild disease like vaccination, which where it fails of superseding the smallpox, yet mitigates its violence, and prevents its fatal consequences, to one whose effects are frequently violent; to one which often occasions deformity and blindness; and, when it is contracted by casual infection, has been supposed to destroy one in six of all that it attacks. And it must not be forgotten, that in a public view this constitutes the great objection to inoculation of the smallpox, that by its contagion it disseminates death throughout the empire, whilst vaccination, whatever be the comparative security which it affords to individuals, occasions no subsequent disorder, and has never, by the most violent of its opposers, been charged with producing an epidemical sickness.

By order of the board,

JAMES HERVEY, Register.

July 18, 1811.

On the Progress and present State of the Practice of Vaccination.

By T. BATEMAN, M. D.

[From the Philosophical Magazine for October, 1811.]

THE objects which the general adoption of vaccine inoculation will accomplish for mankind, if time and experience shall confirm the promises of its benevolent discoverer, are so important, that every friend of humanity must have followed with anxious hope the progress of the practice, and rejoiced at the general result of the evidence in its favour. It is not easy, indeed, to calculate the sum of human misery that will cease to exist, when the prospect which vaccination holds out to us shall be realized. In its casual, or *natural* occurrence, as it is termed, the smallpox is not only the most loathsome distemper that visits the human frame, but the most fatal pestilence; sweeping off multitudes during its prevalence, and destroying

the sight, corrupting the habit, or otherwise inflicting disease on great numbers of those who escape its more destructive effects. The practice of inoculation had, it is true, already diminished those evils among the individuals who resorted to it; but it had unfortunately augmented the evils among the people in general, by the perpetual infection which it disseminated, and the artificial epidemic which it constantly kept up. In London, for instance, during the first thirty years of the eighteenth century, before inoculation could yet have had any effect, the proportionate number of deaths occasioned by smallpox, as stated in the bills of mortality, was about seventy-four out of every thousand: but during an equal number of years at the end of the century, the number amounted to nearly one tenth of the whole mortality, or ninety-five out of every thousand. So that, as far as we are able to judge from hence, the practice of inoculation, which in itself might be esteemed one of the greatest improvements ever introduced into the medical art, has actually multiplied the ravages of the disease which it was intended to ameliorate, in the proportion of above five to four.* And the extent of the mischief inflicted on the survivors is manifest from a statement published by the society for teaching the indigent blind, that nearly one fourth of the persons admitted into that charity have been deprived of their sight by the smallpox; not to mention the various forms of scrofula and other diseases which it frequently excites.

It is true, that the more intelligent classes of society, who have generally adopted the practice of inoculation, have in a considerable degree avoided the worst of these consequences of smallpox: they have seldom been deprived of the blessing of sight; and they have only been destroyed by the disease in the proportion of about one in three hundred. But the humane will shudder at the recollection, that this exemption has been obtained at the expense of so much additional misery inflicted on the people at large; and that they have but shifted a part of the evils from themselves, to be aggravated in the families of their less enlightened neighbours; while they perpetuate a plague, which would otherwise have had its periods of absolute cessation.

* See the Tables drawn up by Dr. Heberden, in his "Observations on the Increase and Decrease of different Diseases," &c. p. 36.

Such is the condition in which the most *improved* state of the art of medicine had placed us, before the benefits of vaccination were discovered; and such is the condition to which some persons would advise us to return, in consequence of the alleged insecurity of this preventive. But it would seem to be only necessary to take a clear and dispassionate view of the state of the facts, relative to the efficacy of the cowpox, up to the present time, in order to be convinced of its incalculable advantages, even were all the reported failures proved to have occurred; nay, if they had actually occurred to double the extent that has been represented. It is the purport of this paper to detail, in as brief a manner as possible, the sum of the facts which have recently been brought to light, and to point out the inference which seems to be justly deducible from them.

The national vaccine establishment, supported by parliament, has published two reports during the present year, containing the evidence which they have collected from various authentic sources. The colleges of physicians and surgeons at Edinburgh, and the faculty of Glasgow, have again given their decided testimony in favour of vaccination. They assert unanimously, that the practice of vaccination is generally approved of by the profession throughout Scotland; that no bad effects can be ascribed to the practice; and that, since its introduction into Scotland, the mortality occasioned by smallpox has very greatly decreased. The faculty of physicians and surgeons of Glasgow further state, that, since the middle of May, 1810, they have gratuitously vaccinated in their hall, 14,500 persons; and that, as far as is known, the "vaccination in all these has succeeded."*

The accounts from several public institutions, in and near London, are equally favourable.† In the royal military asylum

* Report from the vaccine establishment, 1811.

† 1811. It appears, that since the last annual report of the London vaccine institution, there have been inoculated by Dr. Walker, - - 2,490
From the commencement of the institution in 1806, - - - 8,595
By the appointed inoculators in the metropolis last year, - - 1,046
From the beginning, - - - - - 3,109
By the appointed inoculators in the country, - - - - 20,801
From the beginning, - - - - - - - - - 177,474
Last year, charges of matter, - - - 31,992 to 6,539 applicants,
From the commencement of the institution, 93,080 to 18,900 applicants.

for the children of soldiers, where between eleven and twelve hundred are now received, vaccination has been practised since its first establishment in the year 1803. From that period to the present time, but *one* instance of death from smallpox has occurred; and it is worthy of remark, that the individual had not been vaccinated, in consequence of a declaration of the mother, that he had passed through the smallpox in his infancy. Vaccination was introduced into the foundling hospital in the year 1801; and every infant, soon after its admission, has since that period been vaccinated. From the commencement of this practice to the present time, no death has occurred from smallpox; and in no instance has the preventive power of vaccination been discredited, although many children, as a test of its efficacy, have been repeatedly inoculated with the matter of smallpox, and exposed to the influence of its contagion. A similar success has attended the practice of vaccination at the lying-in charity of Manchester, where, in the space of nine years, more than nine thousand persons have been effectually vaccinated, and secured from the smallpox. The officers of the vaccine establishment in London, through the medium of their correspondence with many similar establishments in the country, have learned, that practitioners of the highest respectability are earnestly engaged in promoting the extension of the practice; that, among the superior classes of the people, vaccination is every where generally adopted; and that, although the prejudices of the lower orders, which have been excited by interested persons, still exist, they appear to be gradually yielding to a conviction of its benefits. This inference is likewise confirmed by the fact, that 23,362 charges of vaccine matter have been distributed by the establishment to various applicants from all parts of the kingdom, which exceeds, by nearly one third, the number distributed in the preceding year.

Of the immense benefits resulting from the universal adoption of vaccination in other countries, the accounts from India have furnished the most interesting example. The number vaccinated in the island of Ceylon, from the year 1802 to January 1810, amounts to no less than 128,732 persons; and the smallpox has literally been exterminated from the island.

From the month of February, 1808, to the last mentioned date, the disease had not existed in any part of the island, except in October, 1809, when it was carried thither by a boat from the Malabar coast: but, in this instance, the contagion spread to only six individuals, who had not been vaccinated, and was immediately arrested in its progress, and disappeared. The medical superintendant-general observes, that they have no apprehension that the smallpox will ever spread epidemically in Ceylon, while vaccination continues to be generally practised; at the same time, that its occasional appearance there has the good effect of proving the preservative power of the vaccine pock, and of rousing the natives from their apathy on the subject. Even the Bramins are now surmounting the prejudices of their education, and submitting to be vaccinated.*

It appears from a report of the central committee of the vaccine institution at Paris, published on the tenth anniversary of its establishment, that the benefits of vaccination, in augmenting the population of a country, have not escaped the attention of the present ruler of France, who has formed depôts of vaccine fluid in twenty-four of the principal cities, communicating with the central committee at Paris. In some of the departments, it is said, the zeal of the prefects has been such, that there remain none to vaccinate but the infants born in every year, and that the smallpox is already unknown. And the returns of the mortality in the city of Paris, for the year 1809, exhibit only 213 deaths by smallpox, "This number," say the reporters, "though yet too considerable, since the vaccine offered to these 213 victims a certain method of preservation, is yet extremely small in comparison of that of some years, when the epidemic smallpox has carried off, in the same city, more than 20,000 individuals." The committee, consisting of sixteen of the principal physicians of Paris, express their conviction of the efficacy of vaccination in these terms: "Ten years of labour and success have at length decided the important question, as to the vaccine possessing the power of preserving all those, in whom it has regularly gone through its progress, from the smallpox. This has been carried to such

* See the Report from the vaccine establishment.

a degree of certainty by the experiments of the central committee and its numerous correspondents, as well Frenchmen as strangers, that there is not at present any fact in medicine better proved, or more certain, than that which establishes the truly *antivariolous* power of the vaccine."*

Such is the result of the progressive experience of professional men, in regard to the efficacy and preventive powers of vaccination: such is the confirmation, which the inferences, drawn from the early investigation of this subject, have received from subsequent and more extensive research! Insomuch, that the conclusion of the college of physicians upon the subject, in the year 1807, must now be deemed indisputable, that "the truth seems to be established as firmly as the nature of such a question admits."†

The opposition to the practice, which is still but too successfully kept up by a few clamorous individuals in the medical profession, rests principally upon a mistaken view of the nature of the question. It rests upon the notion that the result of the practice should be uniform and invariable; that the *rule* should be void of all *exceptions*. But there is no such regularity in the operations of the animal economy: there is no disease without its anomalies; and the diversity of human constitutions is infinite. Several of these anomalies, or exceptions to the general rule, have doubtless occurred in the practice of vaccination; "but," to use the words of a judicious and experienced observer, "certainly not so often as was expected by those who considered the subject from the first dispassionately, nor have they been in sufficient number to form any serious objection to the practice founded on Dr. Jenner's discovery."‡ In truth, if this principle were received,—that no operation ought to be performed on the human body which was liable to occasional failure,—what medicine would remain for us to exhibit, or what surgical assistance for us to offer?

But let us examine the nature of these exceptions, or "fai-

* A copy of this report may be found in the Edinburgh Medical and Surgical Journal, for January, 1811. p. 117.

† See the report of the royal college of physicians on vaccination, July, 1807.

‡ See Dr. Willan's Treatise on Vaccination.

lures" as they have been emphatically called, which have occurred in the practice of vaccination. The very sound of the word excites an alarm in the minds of many persons, as if *failure* were synonymous with *death*, or implied the certain occurrence of a desperate or mortal smallpox. But this is so far from being the case, that upon a deliberate view of the facts, we do not hesitate to affirm, that, if all the cases of alleged failure, which the opponents of vaccination have raked up, upon any sort of evidence, and often upon none, had really occurred, and that number had been doubled or tripled, its advantages over the inoculation of smallpox would still be incalculable.

In the first place, it has been ascertained by the concurring observations of almost all the practitioners who have attended to the subject, that (to use the words of the college of physicians) "in almost every case in which the smallpox has succeeded vaccination, whether by inoculation or by casual infection, the disease has varied much from its ordinary course; it has neither been the same in *violence*, nor in the *duration* of its symptoms; but has, with very few exceptions, been *remarkably mild, as if the smallpox had been deprived by the previous vaccine disease of its usual malignity.*"* Dr. Willan states, that the feverishness which precedes the eruption in these cases is often considerable, but the pustules are small and hard, containing little or no matter, and begin to dry off on the sixth day.† It must not be omitted, indeed, that in a very few instances the smallpox subsequent to vaccination has assumed the confluent form, and put on a dangerous aspect (as in the recent case of the son of earl Grosvenor); but even in these rare instances, the modifying influence of the previous vaccination has been manifest, the disease, when near its height, receiving a sudden check, and the recovery being unusually rapid.‡ One case of this sort occurred to the observation of the writer of this paper, in which, on the seventh day of confluent smallpox, the child became suddenly free from constitutional complaint, and ran about at play; a circum-

* See the report of the college. † See his Treatise, sect. iv.

‡ See the last report of the national vaccine establishment, July, 1811.

stance, he believes, that is never known to occur in confluent smallpox where the previous influence of vaccination had not been exerted. In this statement, then, we have admitted the worst consequences that have ever accompanied the "failures" of vaccination, in any one instance.

But, in the second place, let us attend to the proportionate number of these failures. "It does not appear," says Dr. Willan, who minuted the cases as they happened, "that failures in the preventive effect of vaccine inoculation, including *mistakes*, *negligences*, and *misstatements*, have occurred in a greater proportion than as *one* to *eight hundred.*"* It is very improbable, then, that the actual failures amount to one in a thousand, or to any thing near that number. But let us suppose, for the sake of argument, that the failures amount to the proportion of one in five hundred; that is to say, that one of every five hundred persons vaccinated remains liable to be infected by smallpox: and let us further imagine, that this subsequent smallpox is not mitigated in any case, and therefore, that (as in the case of the ordinary *natural* smallpox) *one* in *six* of these will die. Then the worst result would be, that *one* out of every *three thousand* persons vaccinated would die. But we know, that *one* of *three hundred* persons, who receive the smallpox by inoculation, perishes of that disease.† The conclusion is therefore obvious, that the worst result that could be calculated upon from vaccine failures, would leave the balance in favour of vaccination, in the proportion of *ten* to *one*. But when we consider the actual state of the circumstances; that the number of deaths from inoculated smallpox really exceeds the number of "failures" of vaccination; that these "failures" are, in a great majority of instances, the means of insuring a very mitigated and harmless smallpox; and that they have, perhaps, in no instance, been followed by a fatal smallpox; the chances of fatality from a failure of the vaccination are so trivial as to elude calculation; and the only chance of injury that ensues, is reduced to that of a temporary inconvenience.

* See his Treatise, p. 23.

† Dr. Willan states, that "the inoculated smallpox still proves fatal in *one* case out of *two hundred and fifty*."—Ibid.

Lastly, let us reflect on the noncontagious nature of the vaccine disease, which, while it secures the individual from blindness, deformity, or fatuity, too often consequent on the smallpox, injures no one, and spreads no epidemic around, and we shall be compelled to admit, that, "with all its imperfections on its head," with a frequency of failure that its opponents have never yet ascribed to it, vaccination would still prove a blessing, such as few individuals have had the happiness to confer upon mankind.

We might here have terminated our observations, but the leading circumstance, communicated in the late report from the national vaccine establishment, demands some notice. It is singular, that at the time when the public attention was attracted by the occurrence of smallpox after vaccination, in the sons of the earl of Grosvenor and sir Henry Martin, the second occurrence of smallpox in the reverend Joshua Rowley, miss Booth, and two other persons, should have happened. In three of these cases, the previous smallpox had been taken by inoculation, and in the fourth, in the natural way. But the truth is, that the smallpox itself, in whichsoever of these two ways it is produced, is liable to the same anomalies and exceptions as the cowpock. There are several examples of the fact on record; one of the most striking of which is the case of Mr. Langford, related in the 4th volume of the Memoirs of the Medical Society of London. This person was so "remarkably pitted and seamed" by a former malignant smallpox, "as to attract the notice of all who saw him:" yet he died at the age of fifty, in an attack of confluent smallpox, in which he communicated the infection to five other individuals of the family, one of whom also died. It will be unnecessary here to detail the various examples which authors have described. The writer will just notice an instance which occurred under his own observation not long ago, the particulars of which will be detailed in the second volume of the "Medico-Chirurgical Transactions" about to be published.* This occurred in a woman of twenty-five years of age, who was considerably pitted by a former confluent smallpox, which she had suffered

* Several cases and many references will be there found, which are omitted here for the sake of brevity.

in her childhood. She caught the second disease, which went through the usual variolous stages in a mild way, by nursing her infant under a confluent smallpox, which proved fatal to it. It is remarkable, that her two elder children, who had been vaccinated a few years before, lived in the same apartment, during the progress of the smallpox in the infant and mother, and escaped the infection; the cowpock in them having exerted a preventive power, which the previous smallpox had failed to effect in the mother. The poor woman had been prevented, by the terrors excited by the anti-vaccinists, from vaccinating her youngest child: a fact which should induce these opponents of the practice to reflect on the serious responsibility which they assume, in thus discouraging the adoption of this important preventive. I am, &c.

T. BATEMAN, M. D.

Bedford Row, August 19, 1811.

Some Remarks on the Physiology of the Egg: communicated in a Letter from John Ayrton Paris, *M. B. to* William George Maton, *M. D. V. P. L. S. &c. &c.*

[From the Philosophical Magazine for May, 1811.]

DEAR SIR,

THE extensive range which the *ovipari* form in the scale of animated existence renders the physiology of the egg a subject of extraordinary interest and importance to the disciple of Linnæus: I am therefore induced to hope that the communication of any new facts relative to its organization and development will be received by you as an acceptable tribute to the cause of natural history.

The *ova*, or germs of oviparous animals, admit of an evident division into two orders. I. The Perfect, and II. the Imperfect. The former are deposited by the *aves*, *serpentes*, and by most *oviparous quadrupeds*, and are completely formed *in utero;* whilst the latter, produced by some of the *testacea*, *amphibia*, and by most *pisces*, acquire additions after their exclusion. The observations contained in this memoir relate more particularly to the class *aves*, the history of whose *ova*

comprehends whatever is interesting or important in the germs of inferior animals. The egg, when completed and deposited, consists of the following parts:

1. *Vitellus* or *yolk*, with its *capsule* and *cicatricula;* 2. The two *albumina*, with their proper membranes; 3. The *chalazæ;* 4. The *folliculus aëris;* 5. The *common membranes;* 6. The *exterior involucrum*, or *shell.*

The necessity of any description of these parts is superseded by the minute and valuable details which are to be found in the works of Fabricus ab Aquapendente, Harvey, Malpighi, and of many modern and enlightened physiologists; I shall confine myself, therefore, to what I consider exclusively original.

The principal use of the albuminous portion of the egg is doubtless to afford materials for the growth, and nourishment for the support, of the ovular embryon: such however does not appear to be the *only* purpose for which it is designed. No where does nature display more anxiety for the preservation of her offspring, or more wisdom to obtain her objects, than in her provisions to ensure an equitable temperature to the *fœtus in ovo:* a condition which is so essential to the evolution of the animal, that the smallest deviation overthrows the nice balance between the different actions that are to mature it, and produces fatal effects. The *albumen* then I consider as a great defence against such an evil. The *chalaza*, by retaining the *cicatricula* at the source of heat, obviates the mischief that would accrue from constant change of position; but the *albumen*, being a most feeble conductor of caloric, retards the escape of heat, prevents any sudden transition of temperature, and thus averts the fatal chills which the occasional migrations of the parent might induce. As an illustration of the use and importance of such a structure, I may observe, that those fish which retain their vitality a considerable time after their removal from the water, as eels and tench, have the power of secreting a slimy and viscid fluid, with which they envelop their bodies. Is it not extremely probable that this matter, by acting like the albumen of the egg, and preventing evaporation from the surface of the animal, and the consequent change of temperature, may be the principal cause of this tenacity of life?

It must however be remarked, that deviations of temperature are injurious and fatal in proportion only to the degree of vital energy which the ovular embryon possesses: hence germs of inferior vitality not only suffer the vicissitudes of heat and cold with impunity, but are developed by a less defined temperature. We therefore perceive, as we descend the scale of oviparous beings, that those peculiar provisions which the eggs of perfect animals possess, for the regulation of their temperature, cease to be essential, and therefore disappear.

The part of the egg to which I next beg to direct your attention is the *folliculus aëris*, or air bag, placed at its obtuse extremity; the nature of this follicle excited in me considerable interest, as I found that it had not been so fully investigated as its importance seemed to demand.

The external shell, and the internal membrane by which it is lined, constitute the *parietes* of the cavity, whose extent in the recent egg scarcely exceeds in size the eye of a small bird: by incubation, however, it is extended to a considerable magnitude. That its most essential use is to oxygenate the blood of the chick, in my opinion there can be no doubt: but to establish completely the truth of such a theory, it is necessary to discover the nature of the air by which it is inflated, and which has hitherto remained unexamined. We are informed by Buffon, that it is a product of the fermentation which the different parts of the egg undergo. If the count's conjecture be established, it must be nonrespirable, and therefore cannot discharge the office which such a theory would assign to it. To determine this matter, and to discover also whether the process of incubation produces any change in its chemical constitution, I instituted the following experiments, viz.

Experiment I. Twenty-one hen's eggs newly laid, when punctured at their obtuse extremity, yielded only one cubical inch of gas, which, when received in a jar, and subjected to the eudiometric test of Dr. Priestley, I found to be pure atmospherical air.

Experiment II. Two eggs, after twenty days' incubation, were opened under the surface of water, from which one cubical inch of gas was collected: this I also discovered to be at-

mospherical air, contaminated however with a small portion of carbonic acid, which I suspect to be derived from the venous blood of the chick, and which seems to establish another most beautiful analogy between this mode of oxygenation, and respiration after birth.

From these results the following corollaries may be drawn, viz.

1. The *folliculus aëris* before incubation contains atmospherical air.

2. No other chemical change takes place in the constitution of the air, than a small inquination with carbonic acid.

3. It gains by incubation an increase of volume, which takes place nearly in the ratio of ten to one.

I must here remark, that its extent does not increase equally in equal successive portions of time, but observes a rate of progression, which is accelerated as the latter stages of incubation advance: it seems, however, to arrive at its *maximum* of dilatation a few days previous to the exclusion of the animal.

In the eggs of inferior animals, the embryon does not appear to be oxygenated by any distinct apparatus, but, like the animal which it is hereafter to become, receives air through the medium of *spiracula*, dispersed over the exterior *involucrum*. The description of the *folliculus aëris* just delivered is taken from that in the egg of our common hen. The same apparatus exists in the eggs of all birds, and contains a similar air: its capacity, however, does not seem to vary either with the size of the egg, or of the bird to which it belongs; but I think I have discovered a beautiful law by which its extent is modified.

I have uniformly found, as far as my contracted inquiries have led me, that the *folliculus aëris* is of greater magnitude in the eggs of those birds which place their nests on the ground, and whose young are hatched fledged, and capable of exerting their muscles as soon as they burst from their shell, than in the eggs of those whose nests are generally built on trees, and whose progeny are born blind and forlorn. Thus the *folliculi* in the eggs of fowls, partridges, and moor-hens are of considerable extent, whilst those in the eggs of crows, sparrows, and doves are extremely contracted. The chick, therefore, of

fowls and patridges has a more perfect plumage, and a greater aptitude to locomotion, than the callow nestlings of doves and sparrows. Such an instance of the agency of oxygenation in the promotion and increase of muscular power is not solitary in physiology; for the history of ruminating animals will furnish us with a parallel example. "Their cotyledons," observes the author of Zoonomia, "seem to be designed for the purpose of expanding a greater surface for the termination of the *placental* vessels, in order to receive oxygenation from the *uterine* ones: thus the progeny of this class of animals are more completely formed before their nativity than that of the carnivorous classes. Calves therefore and lambs can walk about in a few minutes after their birth; while kittens and puppies remain many days without opening their eyes." If any further testimony be necessary to show that the augmentation of muscular energy is the result of a nice combination of oxygen with the animal organs, many interesting facts might be adduced in confirmation of its truth. We generally find the strength of an animal proportionate to the extent of its chest: hence an attention to the "*animosum pectus*" has been attended with the improvement of our breed of cattle; and it is in consequence of a great extent of pneumatic receptacle that birds are enabled to bear the prodigious muscular exertion of flight. Is it not probable too, that the repeated suspirations of the fatigued are instinctive exertions to procure a greater proportion of oxygen, by which their muscular energy may be revived? I must not quit the subject of this follicle, without noticing a very curious fact well known to every one employed in the concerns of a farm-yard, that, if the obtuse extremity of an egg be perforated with the point of the smallest needle, (a stratagem which malice not unfrequently suggests), its generating process is arrested, and it perishes like the *subventaneous* egg. Hence sir Busick Harwood was led to suspect that the elastic fluid contained in the air-bag was oxygen, and I was induced to examine its nature. Can this curious problem be solved, by supposing that the constant ingress of fresh air is too highly exciting? A parallel example may be adduced from the vegetable kingdom in support of such an opinion. The young and tender plant, before it puts forth its roots, is often

destroyed by having too free a communication with the atmosphere, by which its powers are exhausted: it is to obviate such an effect, that the horticulturist, taught only by experience, covers it with a glass, by which he limits the extent of its atmosphere, and consequently decreases its respiration, transpiration, and the inordinate actions which would prove fatal to it.

I shall close this paper with a few observations on the formation of the exterior *involucrum*, or shell, by which this microcosm is defended from external violence. We here detect a single operation, at once answering two of the wisest and most important purposes of the animal: it at once averts destruction from the individual, and contributes essentially to the preservation of its species; for, whilst it removes the calcareous matter, which, if allowed to accumulate, must render the bird incapable of flight, and defeat the best purposes of its existence, it furnishes the germ of the future animal with a strong and convenient defence. The eggs of birds are, however, sometimes destitute of this provision, which I think may arise from the secretion of calcareous matter not keeping pace with the exuberant production of the fluids of the egg. Hence we perceive this imperfection oftener occurring in strong birds, and in the months of harvest, when their food is more luxuriant and abundant. The experiments of Vauquelin, which prove that the quantity of calcareous matter voided by birds exceeds that taken in, suggested to Fordyce, that birds must require calcareous matter during their laying, and that, if the animal be deprived of it, the shell is never formed. Such a theory, however, is not only derogatory to the wisdom of nature, but illegally deduced from the experiments themselves. Are we to expect, from our imperfect notions of elementary bodies, to explain the origin of every substance found in the animal economy, or the series of changes which it undergoes! Nature has her own laboratory, and is capable, without any foreign aid, of preparing the ingredients necessary for her productions. That a deficiency of calcareous matter in the system is the cause of the absence of the shell, no one will deny; but that this depends on some internal state, and not on the privation of lime, may be shown by the following curious circum-

stance. A hen, which I kept for some experiments, had its leg broken in two parts. The fracture was carefully bandaged; three days subsequent to which, several eggs destitute of shells were found on the premises. The hen had deposited no perfect eggs, nor were there any other birds from which these yolks could have proceeded: I therefore conjectured that all the *calcareous matter* designed for the formation of the shell had been employed in the regeneration of the bone. We find a similar law existing in the human species. The reunion of a bone fractured during a woman's pregnancy is often delayed until her delivery; and it is well known, that, if the horns of a deer be broken at the rutting season, it is incapable of procreating its species.

I remain, dear sir, with great esteem,

Yours, faithfully,

JOHN AYRTON PARIS.

Westminster.

A concise Description of Schooley's Mountain, in New Jersey, with some Experiments on the Water of its Chalybeate Spring. By Samuel L. Mitchell, *Professor of Natural History in the University of New York, Representative in the Congress of the United States, &c. &c. Communicated by the Author.*

[From the Philosophical Magazine for March, 1811.]

THERE had been so much conversation about Schooley's mountain, that in the beginning of July 1810, I executed the desire I had long entertained of visiting it.

Schooley's mountain is a part of a chain which extends in a north-easterly and south-westerly direction across the state of New Jersey. It may be traced from the Highlands of New York. Towards the Hudson, its ridges divide the plains of Rockland county from those of Orange, being denominated the Haverstraw, Warwick, Skunemunk, and Stirling mountains, and being distinguished locally by several other names. Towards the Delaware, it separates the upper waters of the Raritan from those of the Musconetcunck, and passing from Sussex through Morris and Hunterdon counties, is called,

somewhat to the southward of Philipsburg, the Musconetcunck mountain. The more noted portion of its middle region is termed Schuyl's Hills, or Schooley's Mountain. The latter name is the most prevalent, and is derived from a family which was formerly a considerable proprietor of the soil thereabout. The former appellation is probably a mere abbreviation or corruption of it.

This ridge discharges the water from its north-west side, partly through the Walkill, into the Hudson, a little to the eastward of Esopus, after traversing Sussex county, in New Jersey, and Orange and Ulster, in New York. Part also empties into the Hudson through Murderer's Creek, at New Windsor. Another portion is collected into the Musconetcunck river; and running almost parallel with the mountain, falls into the Delaware, not many miles south of Eastown. The water from the south-east side feeds the upper streams of the Passaick, which, after visiting Orange, Rockland, Morris, Essex, and Bergen counties, falls into Staten Island sound, to the southward of Newark. The stream called the Black river beyond Mendham, and that termed South-branch, watering Dutch valley, neither of them reach the Delaware, but empty into the Raritan, some distance above Brunswick.

Thus these heights completely divide the waters of New Jersey. Not a single stream is known to pierce them. From their north-western slope, all their streams find their way into the Hudson and Delaware. From their south-eastern declivity, their currents travel to the ocean by Newark and Raritan bays. They have, however, no pretensions to be classed with the Shawangunk mountains, which are a distinct chain, and make part of the great Allegany, that traverses the continent to the confines of Georgia. Nor have they any connexion with the Kaatskill mountains, which are themselves quite detached from the Shawangunk. Schooley's mountain is of more moderate elevation than either. Geometrical measurement has ascertained that the height of Schooley's mountain above its immediate base is more than six hundred feet. And a calculation made by approximation, on the falls of water at the different milldams along the hurrying channel of the Musconetcunck, to its junction with the Delaware, and on the descent

thence to Trenton, makes the position of that base to be nearly five hundred feet more above tide-water. The elevation above the level of the ocean does not, therefore, in all probability, much exceed eleven hundred feet. And this is about the height ascribed to Anthony's Nose, in the Highlands of New York, by Mr. Knight.

The elevation is, nevertheless, considerable enough to influence its temperature. The heats of summer are not so great as in the valleys. Droughts are less common and pinching. Snow falls earlier, and lies longer than in the adjacent plains. The warmth of a copious spring of pure water, as it issued out of the sand near the top of the mountain, was only 50 degrees, while the temperature of the water gushing from the briskest springs on the north side of Long-island, and drawn from the deepest wells at New-York, is 54 degrees. The spring water on the summit of Schooley's mountain is, therefore, four degrees colder than that around New York.

This mountain is not a mass of stratified rocks, piled upon each other from bottom to top. There is no peculiar difficulty in travelling over it. The predominating materials are clay and sand, forming a good loam; which, though generally not argillaceous enough for the formation of bricks, is, at the same time, gravelly enough for the growth of grass and grain. Yet rocks are thickly distributed over its face and along its sides. They are mostly detached, though some of them are of large dimensions. They consist chiefly of feldspar and quartz: the quartz is prone to be semipellucid, and is granular or angular, resembling coarse marine salt. The feldspar is mostly whitish, sometimes reddish, and presents less of the polished fracture than the American feldspars usually do. It has the appearance of a more imperfect formation, or of having undergone a partial decomposition. These two ingredients make up the bulk of the rocks. Many masses may be examined without observing a vestige of mica. Abundant as mica is almost every where in these parts, with the mixtures of feldspar and quartz, in our primitive rocks, it is remarkably deficient here. Now and then a little schistus, or horneblende, is found embodied and compacted with the quartz and feldspar. Grains of yellow pyrites also somtimes occur. Rust, ochre, and other indi-

cations of iron, are dispersed extensively both through the rocks and the soil. Iron ore is indeed so plentiful, that furnaces are in operation both in the eastern and western districts of the chain. Much of it is magnetical, and its action is so powerful upon the needle, that surveyors of land often find it very difficult to employ the compass. It would be possible to collect great quantities of the magnet, and of other ores of iron in the middle region. Towards the foot of the hills, limestone is found skirting the valleys along, and is calcined in quantity sufficient for all economical uses.

Among the natural productions thereabout, are masses of excellent flint stones. They lie along the valleys and side hills, where they have been washed bare; and are sufficient in quantity and quality for domestic supply of our musketry. They are more pure and of a better fracture than those contained in the limestone near Niagara. And when this important article of public defence shall be thought worthy of being improved by the citizens, there seems to be in New Jersey an inexhaustible supply for our fire-arms.

A turnpike road has been completed from the city of Jersey, at Powleshook, to the summit of Schooley's mountain. The travelling is excellent the whole distance. This is just fifty miles from New York city. Estimating the width of the Hudson to be two miles, the distance to Newark is nine, to Springfield seven, to Chatham five, to Morristown seven, to Mendham six, to Blackriver six, to Dutch-valley five, and to the Mineral Spring on the eastern or further side of the mountain, three miles. Through such a succession of thriving villages, and amidst a country pleasingly checkered with forests and farms, the rise of the first five hundred feet is surmounted in about forty-seven miles, as the traveller passes over a surface of easy elevations and depressions. The remaining six hundred feet are ascended in less than two of the remaining miles, between Dutch-valley and the summit. The principal part of the remainder is a descent to the spring on the opposite declivity.

An able horse will carry a chair hither from New York in a summer's day, or return thence between the rising and setting of the sun. From the top of the mountain one finished turnpike is continued northward, to Sussex, another westward, to

Eastown, and a third eastward, to New York. It is in contemplation to open a fourth from the same point, to proceed in a course southwardly direct to Trenton.

The Mineral Spring which has been mentioned has given much celebrity to the neighbouring region. It is said to have been known to the native Indians, and to have been employed by them as a remedy. The white people have resorted to it almost ever since the settlement of the country. Remarkable cures are ascribed to it: and some persons have been in the habit of visiting it season after season, for the purpose of being benefited by its wholesome properties.

It is situated in the town of Washington, in the county of Morris. It is, in strictness, a rill which issues from a fissure in the perpendicular side of one of the above described rocks, on its eastern exposure. The place of discharge is, perhaps, between forty and fifty feet above the level of a brook which gurgles over the stones, and foams adown the rocks in its channel beneath. The extremity of a wooden leader is so adapted to the crack in the rock as to receive the water, and convey it to the platform where the drinkers assemble, and to the recesses whither the bathers retire.

Its temperature is rather more than six degrees warmer than that of the spring water near the summit. The mineral water, as it pours from the spout, possesses a heat somewhat warmer than 56 degrees. This is about the same which the slower springs and the shallower wells around New York possess.

The quantity of water which it affords can easily be measured. By experiment, it appeared to discharge a gallon in about two minutes and a half. At this rate, the amount would be twenty-four gallons per hour. But allowance is to be made for leakage and waste, inasmuch as the conduit does not collect the whole. Suppose this to be six gallons more. Then the quantity running out will amount to thirty gallons per hour. Some trials are reported to have shown a rather more abundant flow. On the whole, it may be stated with tolerable correctness that the fountain within the bowels of the mountain emits, from this opening, a quantity of water not varying greatly from a barrel per hour, or six hogsheads per day. The

quantity is not observed to vary under any changes of season or weather.

The spouts which convey the water are lined with a yellowish deposit. The like sediment incrusts the reservoirs at the bathinghouse. The earth and stones through which the water soaks away, present a similar ochreous appearance. Where the boards contain astringent matter, a dark purple or blackish colour is formed.

The presence of iron being thus indicated, a few experiments were made to determine the matter more clearly.

A bright blue was produced on adding the prussiate of potash to the w ter.

Green leaves of the common chesnut tree, (*fagus castanea*,) on being bruised and infused in the water, formed a pale purple.

Those of chesnut oak (*quercus prinus monticola*) yielded a brighter purple.

Those of the sumach(*rhus glabrum*)quickly turned to a purple.

Fresh lacerated leaves of the maple (*acer rubrum*) immediately formed a deep purple.

Hickory leaves (*juglans vulgaris*) made a faint dusky hue.

Black oak leaves (*quercus nigra*) struck a darker colour.

Butternut leaves (*juglans cinerea*) afforded a dusky brown.

The waters of the spring, mixed with brandy, made a mixture of a dark and unsightly colour.

An infusion of green tea formed browns, purples, and blacks, according to its strength and proportion.

The chalybeate character of the water being thus established by so many tests, attempts were made to ascertain whether there was any gaseous impregnation.

For this purpose glasses were inverted in a convenient vessel, receiving the stream immediately from the spout. But not a bubble of air was collected, other than common spring water affords.

To determine whether any carbonic acid was combined with the water in a form not spontaneously separable, lime-water was mixed with it; but no change of colour was perceptible in the mixture.

Various proportions of the spring-water and lime-water were mingled in repeated experiments, without effecting any cloudiness or causing any precipitate.

Afterwards, as a test to the goodness of the lime-water, the milky hue and carbonic precipitate of the lime was instantly produced, by breathing through a tube into the mixture of waters, air which had undergone the respiratory operation of the lungs.

There was thus no evidence of any carbonic acid at all.

When the water of the spring was suffered to stand in the open atmosphere, and acquire the summer temperature, by receiving twenty or more degrees of heat, some air bubbles were distinguishable on the sides of the vessel; but they were only such as any cold water would exhibit under equal circumstances.

As there was no calcareous incrustation at the spring, there was reason to believe the water destitute of lime. On adding to it oxalic acid, there was no change of colour produced. Whence it may be inferred that lime makes no part of the constitution of this fluid.

To enable a judgment to be formed whether any other earths were combined with the water, soda and potash were severally and repeatedly added. The precipitates were, however, so small, and so slowly produced, that there was ground to suppose the presence of earthy matter was very inconsiderable, and that there was no metallic impregnation except that of iron.

The nitrate of silver caused a whitish appearance; but not in so considerable a degree as it does in the water of New York, constantly drunk by the inhabitants. The cloudiness was indeed not more considerable than rain-water along the sea-coast is occasionally known to present when subjected to the same test. The tinge of muriatic acid hereby indicated, probably arises from a faint solution of sea salt.

There is notwithstanding a weak acid of some kind in the Schooley's mountain mineral water. If litmus paper be exposed to the water as it issues from the rock, the blue is gradually changed to a reddish; and on the addition of an alkali, the acquired colour vanishes. What the nature of this inconsiderable portion of uncombined acid may be, is not perfectly easy to determine. Its presence is attended with the flavour which water derives from running over decayed leaves, and draining through a soil abounding with the living and dead

roots of trees, shrubs, and sylvatic plants. Former experiments have proved to me the existence of an acid in the rotten wood which overspreads the American forests. And water passing through a stratum of vegetable mould is known to receive what is called the *woody* taste. It is therefore presumable that the rain water receives a tincture from the thick layer of vegetable mould through which it is strained, and carries the flavour of it to the fountain. The peculiarities of this feeble acid, like that of numerous others we meet with in practice, does not seem to be defined in chemistry as yet by discriminating characters.

The iron of this mineral water is very easily separated. Exposure to the atmosphere is followed by a metallic precipitation. Transportation to a distance, as bottles are commonly corked, is attended with a deposition of the iron. The water, after having been carried to New York, when subjected to experiment in my house, gave no evidence of a chalybeate quality when tested by the Prussian alkali and spirituous tincture of galls. This same water, after being boiled in a kettle, makes excellent tea. The heat of ebullition seems to separate the ferruginous ingredient, and the infusion is thereby freed from all dusky or black tint. Still, if this same infusion of green tea is mixed with water fresh from the spring, a dark and disagreeable hue is instantly produced. A short exposure to the heat of 212° thus converts this mineral water into a good tea-water. It is employed for this purpose occasionally.

If there is any thing that deserves the name of a pure chalybeate water in the world, this would seem to be such a composition. The iron appears to be united with the water without the aid of carbonic, or indeed any other acid; for the weak acidity detected by litmus can scarcely be considered as contributing to its solution. Some part of the iron ore universally diffused among the minerals hereabout, is in a state proper for water to act upon, and to produce the martial impregnation remarkably free from other admixtures.

Schooley's Mountain, July 10, 1810.

Case of Poison by Arsenic. Communicated by Mr. Soden, *Surgeon, Coventry.*

[From the London Medical Review for April, 1811.]

MARCH 15, 1810, a little before eight o'clock in the evening, I was called to O. Y. aged 22. His father had discovered that he had purchased a quantity of arsenic since seven o'clock, and strongly suspected that he had taken some of it.

I found him vomiting, and complaining of dreadful pain in the stomach. His pulse was very rapid, and his legs were slightly convulsed. After some hesitation he acknowledged that he poured about half a pint of water upon a shilling's worth of arsenic; had stirred up the mixture, and swallowed it. An emetic, consisting of a scruple of sulphate of zinc, and two grains of tartarized antimony, was immediately exhibited. He discharged a considerable quantity of fluid from his stomach. The sickness was encouraged by repeated draughts of warm water, and milk and water. He suffered severely from a burning sensation in his stomach, and the vomiting continued till about half past nine; at which time he was attacked with diarrhœa, and constant inclination to void urine. The pain became intolerable in his bowels, the convulsive motion in his limbs were more frequent, and his pulse more feeble, but still very quick.

As it was obvious that part of the poison had reached the intestines, fifteen grains of scammony were given, a drachm of sulphuret of potash was dissolved in a quart of water, and he was desired to drink a cupful of this solution very frequently. A clyster of warm milk and water was thrown up to shield the coats of the intestines from the corrosive effects of the mineral, and his attendants were directed to inject some warm gruel into the rectum after each stool.

These means were diligently employed, but the dangerous symptoms increased with uncommon rapidity. The violent pain soon subdued him, his pulse sunk, his extremities were cold, and, about twenty minutes past eleven, after a dreadful convulsive laughter, his limbs became suddenly rigid, and he expired.

The body was opened about twelve hours after death, in the presence of Dr. Terry, Mr. Wilmer, and Mr. Tookey, of this city. The stomach and intestines appeared highly inflamed. The stomach was distended with a dark brown fluid: about two ounces of arsenic were found at its most inferior part. The vessels of the inner coat of the stomach looked as though they had been beautifully injected. The stomach generally was corrugated and puckered, but more particularly at that part which was in contact with the arsenic. The urinary bladder was contracted to the smallness of a walnut. The pleura of the lungs was with difficulty separated from the pleura costalis. The heart was firmly and universally united to the pericardium, and the pericardium to the pleura of the lungs. The brain was not examined.

Upon inquiry, it was ascertained that this unfortunate young man had purchased seven ounces of very finely powdered arsenic. It is impossible to state the precise quantity swallowed, as the paper containing a portion of the mineral was found under his bed, but was thrown away before I was informed of the discovery. There is however, reason to believe that he took more than four ounces of arsenic; a circumstance that readily explains the rapid termination of the case, and the highly inflammatory appearance of the viscera.

The subject, whose case I have narrated, passed my examination as a recruit for the army, and appeared healthy the day on which he died.

An Account of the Symptoms and successful Treatment of a Patient who swallowed a large quantity of Laudanum. Communicated by Mr. S. H. Murley, *Surgeon.*

[From the London Medical Review for October, 1811.]

A YOUNG woman, twenty years of age, on the 15th of July, 1811, took ten drachms of laudanum about eleven o'clock in the forenoon, which was not discovered till near two in the afternoon of the same day. The whole of the laudanum had been retained on her stomach, notwithstanding she had taken a strong solution of the sulphate of zinc. When I first saw her, about three o'clock, she appeared much convulsed, her hands

and jaws were firmly closed, her countenance of a ghastly paleness, and she was totally insensible. As the sulphate of zinc had produced no effect, a solution of the sulphate of copper with some ipecacuanha was given every ten minutes, until vomiting was produced. The temples and nostrils were constantly irritated with hartshorn, and after she had taken about three doses of the solution, vomiting came on, which in some degree roused her. By the assistance of two persons she was kept constantly walking or rather dragged about the room, and the operation of the emetic was promoted by draughts of warm water. Not the slightest smell or appearance of laudanum could be perceived in the fluid that was ejected. She complained of insupportable drowsiness, and weakness in her knees, urging her inability to walk, and requesting that she might be allowed to sleep. The emetic was repeated, but no laudanum was rejected. When the action of the emetic had ceased, I caused her to drink a considerable quantity of vinegar and water, still keeping her walking or in a state of agitation. At length she became less drowsy and towards evening could walk with little assistance, but appeared very much exhausted. A mixture with ammonia was now given, and she was permitted to lie down in bed, but her attendants were desired to rouse her frequently during the night. On the following morning she complained of much pain and confusion in her head, with numbness of her extremities, and her bowels were obstinately costive. A large blister was applied between the shoulders, and strong doses of purgatives were given, but without producing any discharge from the bowels. In the evening I ordered the abdomen to be well rubbed with salt and to be fomented, which speedily produced a copious discharge of dark-coloured and very offensive fæces. The numbness of the lower extremities, which indeed almost surmounted to paralysis, and an inability to contain her urine continuing, sinapisms were applied to her feet, which seemed to be of service. She remained for some days in a very lethargic state, with pain in the head, dimness of sight, and a constipated state of her bowels. These were relieved by the use of purgatives, and she is now perfectly well.

SELECTED REVIEWS.

A Treatise on the Process employed by Nature in Suppressing the Hemorrhage from divided and punctured Arteries; and on the Use of the Ligature; concluding with Observations on Secondary Hemorrhage; the whole deduced from an extensive Series of Experiments, and illustrated by 15 *Plates.* By J. F. D. Jones, M. D. Member of the Royal College of Surgeons of London. 8vo. pp. 237. London. 1805.*

[From the Edinburgh Medical and Surgical Journal for 1806.]

OUR curiosity, early attracted by the importance of the subjects announced in the title, has been amply gratified by the perusal of this interesting volume, which has left upon our minds very favourable impressions of the critical judgment of the author, as well as of his talent for experimental inquiry.

Few facts in physiology are more curious, or more interesting to the naturalist, than those which belong to the subject of animal reproduction. There are few of higher importance to the surgeon; for this knowledge points out to him, in many cases, at once the object and the limits of his art. The process employed by nature in the reproduction and reunion of separated parts are the fairest subjects of experimental inquiry, and the labours of many ingenious men have accordingly been rewarded by the deriving of new and important facts. The observations and experiments of Duhamel, Haller, Troyes, and M'Donald; of Murray, Huhn, and Hunter; of Cruickshanks and of Haighton, leave, indeed, little to desire in the departments which they have examined.

From the most perfect restoration of a lost or amputed part, to the cicatrization of the simplest wound, we observe a uniformity in the attempts of nature at reproduction, or a series of analogous events, which expound to us the process of nature in the reproduction and reunion of the bones, and of most of the soft parts of animals. The process employed by nature in suppressing the hemorrhage from divided arteries, though perhaps of all the most important to be fully understood, has not been so perfectly explained. Experiments and observa-

* Lately republished by Thomas Dobson, Philadelphia.

tions, indeed, have not been more neglected here; badly imagined, however, and limited in their direction, by the influence of some hypothesis to be confirmed or refuted, they leave us still uncertain of the truth. Some steps of the process have been seen or affirmed, while others, equally important and efficient, have been overlooked or denied. Limited observation, and the inclination to simplify the mechanism of nature, have led to theories founded on some one or other of the steps of the entire process; and hemorrhage has been supposed to be naturally stopped by an obturating clot of blood, by the contraction and crispation of the divided artery itself, or by the tumefaction or injection of the surrounding cellular substance. The limited theories of Petit, of Morand, and of Pouteau, gave rise to other subordinate hypotheses not more satisfactory. Distrusting, then, these results of partial observation and of hasty conjecture, to arrive at the truth, it was necessary again to consult nature herself; and by a series of observations and experiments, carried on through every stage of the process, from the first effusion of blood to the natural suppression of the hemorrhage, and complete cicatrization of the wounded artery, to mark the various changes which take place, and the order in which they succeed: a task which has been undertaken and executed, with equal zeal, ability, and success, by Dr. Jones.

The experiments are numerous, but not redundant; they are well imagined, skilfully executed, and, to all appearance, faithfully related. The results are also exhibited in 15 neat engravings. The experiments are compared with, and his observations are afterwards illustrated and confirmed by, those of other eminent physiologists and surgeons. For the error of his predecessors seems to have been chiefly that of seizing exclusively one step of the process of nature which they really did observe, and of hastily concluding that they had nothing farther to look for. So far, indeed, as they did observe, their observation was correct and accurate; but this being limited to some particular period of the process, they differently saw the corresponding steps of a series of changes, which really constitute the process of nature in suppressing the hemorrhage from divided or wounded arteries.

Dr. Jones having examined and freely exposed the defects

of Petit, Morand, Sharp, Pouteau, Gooch, Kirkland, and J. Bell, proceeds in the relation of a series of experiments on the arteries of horses and dogs, undertaken with the view of ascertaining the process employed by nature in the suppression of hemorrhage from *divided* arteries, and the order of the events which constitute it. In these experiments the larger arteries were completely divided; the suppression of the hemorrhage was left to nature, and the condition of the divided vessel was, in the different cases, ascertained by careful examination, at different periods, after the first cessation of the hemorrhage. Though we must refer to the original for a full detail of those experiments, we shall here quote the following as examples.

EXPERIMENT VII.

'The femoral artery of a dog was divided, and the integuments were brought together, as in Experiment II., the section of the artery being made as high as it was detached. Half an hour after the hemorrhage had completely ceased, the dog was drowned.

'Dissection. A considerable clot of blood was found between the integuments and the artery, covering both of its cut extremities, and adhering to the lower, and to the parts about it: the extremities of the artery were nearly an inch distant from each other: a black cylindrical coagulum was found stopping up the mouth of the upper extremity, and extending at least one third of an inch down from it, and between the vein and nerve. The mouth of this extremity was slightly contracted. The division of the artery appeared to have been made immediately at its connexion with the cellular membrane; this appearance was, no doubt, rendered more complete by the retraction which had taken place. There was an effusion of blood between the artery and its sheath, to the extent of at least two inches: there was also a considerable effusion in the surrounding cellular membrane; but the artery had not the slightest appearance of being compressed by it. On cutting open this part of the vessel, a long and very slender coagulum of blood was found within it, which by no means filled up its canal at any part, nor adhered to the internal coat of the artery. Hereafter I shall call this the internal coagulum, to distinguish it from the external.

About four lines breadth of the inferior portion of the divided artery was detached from the surrounding cellular membrane; its mouth was much more contracted than the upper, and was slightly turned on one side; it adhered to the clot, which filled the wound, and lay over it; and the internal coagulum was very slender and thready.

EXPERIMENT XVII.

'The carotid artery of a horse was divided just above a ligature, which had been made on it to prevent hemorrhage from that portion of it next the heart, and the integuments were secured by sutures previously passed. The blood flowed too fast at two or three interstices, but these were closed by additional sutures, and the external hemorrhage presently ceased. A very large tumor instantly formed, but its size considerably diminished in the course of twenty-four hours. The animal was killed sixty-six hours after the operation.

'Dissection. The clot, which originally filled the cavity of the wound, and distended the integuments, had nearly disappeared, having been either washed away by the discharge or absorbed. The ends of the artery were separated between one and two inches. The sheath was tinged with blood to the extent of many inches. To the circumference of the cut artery, and just within it, the external coagulum, consisting partly of lymph, partly of blood, adhered. Its figure was conical, and it was supported at the mouth of the artery by its intimate connexion with the inner lamina of the sheath, which, by the retraction of the artery, formed a canal for it; and it derived farther support on all sides, from the blood effused and coagulated between the inner and outermost lamina of the sheath. The internal coagulum was an inch and a half long, corresponding to the distance between the external coagulum and the first collateral branch. It completely filled the canal of the artery, and had every appearance of having been formed soon after the operation. It was quite detached, and lay two inches above the external coagulum, having, in all probability, slipped from its original situation in handling the parts previous to the artery being opened. See plate II. fig. 2.'

EXPERIMENT XIX.

'The femoral artery of a dog was divided, and the integuments were brought together in the manner already described. The animal was killed nine days after the operation.

'Dissection. The wound was open, but its extent much diminished. Its surface was formed of a thick layer of very vascular lymph, which being divided, discovered the truncated extremities of the artery half an inch apart. The cellular membrane surrounding each extremity of the artery, for the space of an inch, was very much thickened with coagulated lymph. The superior portion of the artery was slightly contracted at its extremity, which was completely closed, and filled up with lymph. From this closed extremity extended, about two lines breadth, a small rounded whitish substance, of the consistence of jelly, which, probably, was the remains of the external coagulum not yet absorbed. Within this portion of artery we found a small conical coagulum of blood, attached at its base to the lymph that closed the mouth of the artery, but not adhering to, nor even appearing to touch, any other point of its internal surface.

'The inferior extremity of the artery was much more contracted than the superior, its termination being very distinctly of the figure of a cone. On cutting it open, we found its mouth completely contracted, and adhering to the lymph that closed it. An internal coagulum, similar to that of the superior portion of the artery, was attached to this lymph. The coats of both portions of the artery were very much thickened. See plate I. fig. 4.'

Not one, then, but a variety of circumstances conspires in the natural suppression of the hemorrhage from *divided* arteries. The divided artery retracts; and contracts the force of the circulation, after the first impetuous flow of blood is gradually weakened and reduced; the blood is effused into the cellular substance, and the sheath within which the divided artery had retracted; the effused blood is here entangled, and the foundation laid for the formation of a coagulum, which fills the sheath and cellular membrane, and eventually closes up the

mouth of the artery; and this, which is termed the external coagulum, is the first complete barrier to the effusion of blood. "This coagulum, viewed externally, appears like a continuation of the artery; but, on cutting up the artery, its termination can be distinctly seen with the coagulum completely shutting up its mouth, and enclosed in its sheath."

The next step in the process is the formation of the *internal* coagulum, the clot within the artery, a slender conical clot which lies loose in the arterial canal, and connected with the artery only by its base, which, by its circumference, is slightly attached to the divided extremity of the vessel. The formation of this internal coagulum, however, appears to be merely a contingent event in the process, and depends on the cessation of the circulation in that part of the artery which lies between the first collateral branch and the divided extremity, after that extremity has been closed, and the hemorrhage stopped by the external coagulum. The figure and size of the internal coagulum vary according to the remoteness of the first collateral branches, and where this goes off very near to the divided extremity of the artery, the internal clot is often not to be found. "The *internal* coagulum contributes nothing to the suppression of hemorrhage in ordinary accidents, because its formation is uncertain, or, when formed, it rarely fills the canal of the artery, or, if it fills the canal, does not adhere to the internal coat of the artery."

Soon after, there is observed, between the external and internal coagula, a layer of coagulable lymph, poured out by the inflamed vessels of the cut extremity of the artery, to the internal coat of which this coagulum of lymph is firmly united. And now, by the gradual contraction of the artery, and by the effusion of lymph, these parts become intimately blended together; the canal of the artery is obliterated, and its extremity lost in the surrounding parts. Thus, the *temporary* suppression of the hemorrhage is accomplished by the retraction and contraction of the artery, and by the formation of the coagula, or clots of blood; *permanent* security is afterwards obtained by the effusion, consolidation, and organization of coagulable lymph. The artery, however, gradually undergoes other changes: "Its obliterated extremity no longer allowing the blood to circulate

through it, the portion which lies between it and the first lateral branch is no more distended and excited to action as formerly, but gradually contracts, till at length its cavity is entirely obliterated, and its condensed tunics assume a ligamentous appearance." "At the same time, the remarkable appearances at the extremity of the artery are undergoing a considerable change; the external coagulum of blood, which, in the first instance, had stopped the hemorrhage, is absorbed in the course of a few days, and the coagulating lymph which had been effused around it, and had produced a thickened and almost cartilaginous appearance in the parts, is gradually removed, and they again appear more or less completely restored to their cellular texture."

Such is the outline of the process employed by nature for the suppression of hemorrhage from *divided* arteries, as more fully deduced by our author from his own experiments and observations, and which he very happily illustrates and confirms by a judicious exposition and criticism of some of the observations of Pouteau, Kirkland, Morand, Gooch, Haller, and others.

Let us conclude, then, with Dr. Jones, that "we can no longer consider the suppression of hemorrhage as a simple, a mere mechanical effect, but as a process prepared by the concurrent and successive operation of many causes. These may be briefly stated to consist in the retraction and contraction of the artery, the formation of a coagulum at its mouth, the inflammation and consolidation of its extremity by an effusion of coagulable lymph within its canal, between its tunics, and in the cellular substance surrounding it."

We now pass to the 2d chapter of this treatise:—"On the means which nature employs for suppressing hemorrhage from *punctured* or *partially divided* arteries; and on the process of reparation which takes place in those arteries."

The common consequence of a punctured artery, in man at least, is the formation of aneurism; and the experiments of this chapter were originally instituted with the view of ascertaining the manner in which aneurism is produced, and with little hope of witnessing the complete and perfect reunion of a partially wounded artery. But Dr. Jones found it very difficult to

produce aneurisms in the arteries of horses and dogs; on the contrary, he discovered that, when the artery was simply punctured, the wound often cicatrized by a process of reparation, its canal continuing pervious, and its functions entire; or, when a larger portion of the circumference of the artery was wounded, that either the canal of the artery became obstructed, or that a complete division took place by laceration or ulceration.

We shall take the 6th of this series of experiments as an example of the cicatrization of a punctured artery.

EXPERIMENT VI.

"The carotid artery of a dog was laid bare, and a longitudinal wound made in it with a lancet, without removing it at all from its situation or surrounding attachments; a profuse hemorrhage followed; the integuments were sewed up as quickly as possible, and soon after they were found distended with blood, and the hemorrhage ceased.

"Nine days after this experiment the animal was killed, and, on examining the parts, the external wound was found to be very nearly healed. Its surface was formed by a vascular layer of lymph. The artery was injected from the aorta, and the injection passed very readily through it. As it had been wounded anteriorly, I cut open its posterior part, immediately opposite to the wound. The canal of the artery and the injection were very slightly narrowed just at this part; the coats of the artery and the surrounding cellular membrane were very much thickened. On picking away the portion of injection which passed through this part of the artery, the longitudinal wound was seen to be completely cicatrized. There was a collateral branch filled with injection on one side of it, and on the other a very thin lamina of lymph, adhering to the internal surface of the artery. See plate V. fig. 3."

But if those animals had been longer preserved, if they had fully recovered their blood and health, if they had been allowed to return to their wonted freedom and exercise, might not these cicatrized arteries have dilated into aneurisms? However this may be, the process of cicatrization, as deduced from these experiments, appears to be this:—The sheath becomes injected with blood; the relative position of the puncture in the

artery and in the sheath is altered, so that they no longer oppose each other; a layer of coagulated blood is confined by the sheath over the puncture in the artery, and forms the *temporary* barrier to farther hemorrhage. Lymph is now effused under the coagulum of blood, and the process of reparation is completed in the usual way, till permanent security is obtained.

Though it appears, from Dr. Jones's experiments, that the punctured arteries of brute animals may thus be cicatrized, and their functions preserved entire, we are not to flatter ourselves with equal success in the surgery of wounded arteries in man. Although there is such an appearance of cicatrix in a case quoted from Petit, we perfectly agree with Dr. Jones, that in the treatment of a wounded artery, " in every case in which it can be done, it is best to tie the artery above and below the wounded part, and to divide it between the ligatures."

Chapter 3:—" On the operation of the ligature; showing that its immediate effect is to divide the middle and internal coats of an artery which gives rise to the adhesive inflammation."

The experiments contained under this head are novel, and highly interesting. In these, after exposing the arteries, ligatures were passed round them, and tied in the usual way, but, immediately afterwards, loosened and withdrawn; the freedom of circulation was instantly restored, and the blood passed through the artery as before the application of the ligature. Yet, very shortly after, the artery became obstructed, and was eventually cicatrized for some way above and below where the ligature had operated, and that as effectually as if the ligature had been suffered to remain. The process by which this is brought about seems to consist of the following parts: The internal and middle coats of the artery are torn or divided by the ligature, an observation first made by Dessault, and confirmed by Mr. Thomson and by Dr. Jones: the divided coats inflame; coagulable lymph is poured out so abundantly as to obstruct the arterial canal; above and below this obstructing coagulated lymph there are formed internal clots, or coagula of blood, as far as the first collateral branches, which complete the obstruction, and at length all this portion of the artery becomes cicatrized, with the circumstances more fully exposed by our author in the next chapter, " On the process of adhe-

sion, and the changes which an artery finally undergoes, in consequence of the application of the ligature."

In the experiments undertaken with a view to the investigation of this process, the ligatures were applied in the usual manner, and allowed to remain, the artery being, in some, divided between two ligatures, and allowed to retract, and, in other cases, left undivided.

From the whole of Dr. Jones's experiments, it appears that the effects of tying an artery properly are,

1*st*, To cut through the internal and middle coats of the artery, and to bring the wounded surfaces into perfect opposition.

2*d*, To occasion a determination of blood on the collateral branches.

3*d*, To allow of the formation of a coagulum of blood just within the artery, provided a collateral branch is not very near the ligature.

4*th*, To excite inflammation on the internal and middle coats of the artery by having cut them through, and consequently to give rise to an effusion of lymph, by which the wounded surfaces are united, and the canal is rendered impervious; to produce a simultaneous inflammation on the corresponding external surface of the artery, by which it becomes very much thickened with effused lymph; and, at the same time, from the exposure and inevitable wounding of the surrounding parts, to occasion inflammation in them, and an effusion of lymph, which covers the artery, and forms the surface of the wound.

5*th*, To produce ulceration in the part of the artery round which the ligature is immediately applied, viz. its external coat.

6*th*, To produce indirectly a complete obliteration not only of the canal of the artery, but even of the artery itself, to the collateral branches on both sides of the part which has been tied.

7*th*, To give rise to an enlargement of the collateral branches.

A knowledge of the changes which an artery undergoes, in consequence of the application of the ligature, explains to us,

at the same time, its occasional failure, and instructs us how to avoid some of the causes of secondary hemorrhage; those, at least, which depend on the improper form and application of the ligature. And, with some very pertinent remarks on this subject Dr. Jones brings his treatise to a close.

It is proved by some experiments of Dr. Jones, that, to produce those changes in the artery which terminate in the adhesion of its coats and obliteration of its canal, which it is our object to attain by the proper application of the ligature, it is necessary that the internal and middle coats of the artery be completely divided by the ligature; and hence that form and mode of application, which are best calculated to produce this requisite division of the internal coats, must be preferred. Large flat ligatures are therefore improper; round ligatures, which are small and sufficiently firm, are preferable; they should be perfectly regular. No part ought to be included in the ligature but the artery. Care should be taken to tie the ligature with sufficient force, and always as nearly as possible in a direction perpendicular to the axis of the artery. The artery itself should, in every case, be as little as possible detached from the neighbouring parts: and, if experience has discovered any advantage in the mode of tying and dividing the artery between two ligatures, Dr. Jones is disposed to think that this advantage consists in the artery being tied close to the part at which its connexion with the surrounding cellular membrane is complete; whereas, when a single ligature is used, a considerable portion of the artery is detached, and the ligature, perhaps, applied in the centre; or, if applied at the upper end, still there remains a considerable portion of detached artery below it.

From the foregoing analysis, our readers will be enabled to anticipate the general merits of this excellent treatise. To us it appears a work of uncommon merit, and we doubt not our judgment will be confirmed by every one who, after an attentive perusal, considers the unusual labour bestowed upon it, the great number of facts contained in it, the excellence of the plan by which all those facts are arranged, the precise and accurate development of the most important processes, of which very inadequate and confused notions had been formerly en-

tertained, and the industry and fidelity with which they have been illustrated by the scattered facts relating to these collected from the writings of others.

Practical Observations on Cancer. By the late JOHN HOWARD, *Fellow of the Royal College of Surgeons, and Surgeon Extraordinary to the Cancer-Ward in the Middlesex Hospital. London*, 1811, *pp.* 144.

[From the New Medical and Physical Journal for Dec. 1811.]

SO little has hitherto been accomplished towards the attainment of a complete knowledge of the nature of cancer, and the treatment of this disease is still so far from being tolerably successful, that a wide field is yet open for the labours of the pathologist and the experiment of the practitioner; every attempt, therefore, to facilitate our progress in this important inquiry cannot but be received with satisfaction by those who have at heart the advancement of the healing art, and the alleviation of human suffering. The opinions and experience of a surgeon much occupied in the treatment of this disease cannot fail of being interesting to his professional brethren; and although the author may not have thrown much additional light on the nature of cancer, we conceive he has afforded many important hints, calculated to induce surgeons to adopt a judicious and improved method of treatment. A very important step, previous to the investigation of the causes and progress of cancer, is, to distinguish it from other diseases to which it bears resemblance, or with which it may be confounded. Our author has attempted to do this, not by giving a formal definition of the disease in a few words, but by describing the various circumstances under which the disease most frequently occurs, the temperament or constitution, the age and habit with which it is generally accompanied. After stating that cancer is originally a disease of a gland or glands, and demonstrating that the glandular system occupies a very extensive and important part in the animal economy, the author enters into an inquiry, whether a certain relation does not exist between scrofula and cancer; the appearance of disease in the one form or the other

depending upon the age, or other circumstances of the individual.

" From the most careful observations I have been able to make, for many years, it has appeared that a number of the most deplorable cases of cancer, towards the decline of life, have been in habits apparently scrofulous, from the complexion and from other circumstances. It has been admitted, that scrofula in infancy, childhood, and during the progress of life, towards puberty, is characterized by different appearances from those of more advanced age. Not that I mean to say that cancer is a disease strictly speaking of the lymphatic glands; for it is generally an affection of other glands of a very different kind, and destined to a very different purpose in the animal economy. But it is nevertheless probable that the lymphatic system, if not the lymphatic glands themselves, at a late period of life, may have an immediate and near connexion with this disease. We know well that a wonderful attraction may take place from age, not only in the nerves, arteries, and veins of the human body, but in every gland throughout the body, and in every viscus in it. Is it therefore probable that the lymphatics are the only organized parts exempted from this general change? Scrofula has been supposed, at least early in life, to be a disease of the lymphatic system and lymphatic glands. The disease, after puberty, and during the state of manhood, and also during the middle state of life, in men and women, may no longer manifest the same character. The original character may be blended with other diseases in the system, as cough, consumption, obstruction of the mesenteric glands, &c. But later in life, when alterations are daily taking place in the habit, and in its general economy, the lymphatic glands, in common with all other glands of the body, undergo remarkable changes. The lymphatic vessels themselves are connected with every gland of the body, and they are as essential to man as nerves, arteries, and veins; these therefore may be influenced by time, accident, or age, and may also undergo a change; and that of a morbid kind. It has been generally supposed that scrofula, as has been stated, is a disease most prevalent in the more early part of life; if it be admitted that it may remain quiet for years, may it not afterwards assume, in the same

person, new forms? To enter into the variety of forms which this disease may assume, would be foreign to my purpose; but from the prevalence of cancer in scrofulous habits late in life, I am convinced that this is a common termination of it.

" Scrofula has been long believed, by intelligent men, to be frequently an hereditary disease: that from some wonderful coincidences it may lie dormant in one child and be active in another; and that it may lie dormant, for a generation even, and revive in another. If these be facts, why may it not also be inactive in the same individual during the middle period of life, after having manifested its character in infancy, and on to puberty? and why may it not return towards the decline of life in a new form—in the form of cancer? Cancers of the throat and tongue, I suspect, have thus originated; and cancers of the uterus, and of the breasts of women at an advanced period, I have great reason to believe, in many instances, partake of the same leaven."

A similar connexion is also said to exist between cancer and lepra, elephantiasis, and hereditary diseases of the skin; or that these latter may prove either predisponent, or exciting causes of cancer; but this proposition is by no means clearly established. Indeed, in treating of the causes of cancer, we think the author is particularly obscure and confused; nor do we conceive that any satisfactory information can be derived from what is here laid down on the subject.

" There seems to be a predisponent, an exciting, and a proximate cause in the production of every cancer. Thus, a blow on a glandular part may be the predisponent cause, but the exciting cause may be whatever is capable of putting the first cause into action and further motion. If I take a number of persons, and suppose them all to have received injury by the predisponent cause above mentioned, the particular habits of these persons may come in as auxiliaries to carry on the effects of the blow. Here then an hereditary disposition to cancer, a tendency to lepra, to cutaneous diseases, or what are vulgarly called humours, by a kind of metastasis to the injured gland, may become exciting causes. But when no such accident has happened, these are of primary consideration, and may be predisponent to other cancers: and we must look elsewhere for

the exciting cause. We know that in women, as age advances to a certain period, a remarkable alteration of structure takes place in glandular parts; those in the breast, which were destined for the secretion of milk, become useless; and the uterine glands are no longer influenced by menstruation; added to which, other changes do frequently take place at the same period in the whole system, or general economy of the body; and these incline many women to erysipelas, gout, rheumatism, asthma, and to congestions in various parts, but more particularly in the legs. Any of these different affections may be the exciting cause; thus, what were after a blow exciting causes, may be predisponent under different circumstances, where no such accident has ever happened; and in this light I must consider an hereditary disposition to cancer, a tendency to lepra, to cutaneous diseases, or what have been termed humours, as predisponent or exciting. In such cases, the co-operation of the predisponent, with the exciting cause produces a third cause which may be called the proximate in the formation of a scirrhus, which I take to be the first germ, or beginning of cancer." It is surely contrary to the generally received notion of causes, to call a blow the predisponent cause, and the previous state of the system the exciting cause; it is the state of the system which commonly determines whether this or that disease shall be produced by an accidental injury, which is the cause that actually excites the disease into action; the hereditary disposition to cancer, instead of being, as the author says, the exciting cause is clearly the predisponent, without which hereditary disposition, the accidental blow, his predisponent cause, would only have produced simple phlegmon.

Among the causes of cancer, animalculæ have been reckoned: but Mr. Howard does not seem disposed to admit them into the list; they have been found to exist in the human subject without producing cancer. Neither is the author satisfied that hydatids have any connexion with cancer; in one operation, he saw an hydatid appearance of the cellular membrane, during the removal of the breast; the knife having made a division of soft, not of glandular, parts, which looked much like hydatids, when cut transversely. This circumstance was considered by the author as a peculiar mark of the disease having extended

to the cellular membrane. He never recollected having seen such an appearance before or since. "If the cause of some cancers," says the author, "be a virus, I suspect it is not strictly speaking sui generis, as the small-pox, but an affection of the leprous, or of the elephantiasis kind; and this may, in some measure, account for the great frequency of its repullulation." It is not evident how the frequent repullulation of the disease can be more easily explained by supposing the cancerous virus to partake of the nature of lepra, or elephantiasis, than if the cause of the disease were, as is probably the case, a virus *sui generis*. In either case, while the predisposition existed in the system, the disease would be easily reproduced by the application of the exciting causes.

Of the progress of the disease from its state of scirrhus, which perhaps at first may be confined to a single miliary gland of the skin, to extensive ulceration, the author has given a just description; the following observations, we think, claim considerable attention.

"The tumour having increased, or grown to such a size, that the skin can no longer bear its pressing forwards, it gives way, and the cancer is then ulcerating, or already ulcerated. When ulcerated, it may spread either slowly or rapidly, and the sore may be small or large. There is, however, a circumstance I have sometimes seen, which is not an immediate and direct ulceration (I mean not a deep one), but an exudation from the pores of the skin, followed either by an excoriation, or scab, or both. This scab, or crust, defends the part for a time from further ulceration, and seems to check the growth, in a measure, in some, and alter the figure of the tumour in other cases; and I have sometimes seen it tuck down in the middle of the tumour, having a thick, reddened, hardened circumference, like a wall round it, approaching sometimes to a figure nearly circular. To the formation of this scab I must desire the reader to attend particularly. It may be considered as the work of nature to relieve herself, which gives some respite to the patient from the more distressing ravages of the disease; and it is for a time, at least, a defence from irritation and further ulceration. I have known it remain for months and years; and it supersedes, in some measure, every topical application.

This, however, can only last for a period; and if it be picked off, or otherwise irritated, rapid ulceration will probably follow. But it may happen, in some cases, to fall off, and to be renewed from time to time without much increase of irritation. At first it is hard, and as was before said, crusty; and this crust may increase as the discharge increases and accumulates; it softens however by degrees, and at length becomes a slough. Let not this appear a trifling circumstance; for the prolongation of life depends on this scab, in as far as it checks the progress of the disease to ulceration; which latter, when once established, is sure to lead to fatal consequences."

However small may be the original tumor, it seldom fails to extend its ravages to the neighbouring glands; the quick progress of the disease, the author thinks, may depend on a glandular sympathy or attraction; or, he says, the tubercle or gland may be compared to the bulbous root of a plant in the earth; or to a fungus or toad-stool on the bark of a tree, which vegetates in every direction; for fungus excrescences are common on the bark of the oak, the larch, and on other trees. What is an ordinary wart, but an excrescence growing in the skin, and common integuments? These, though not cancerous, are species of morbid animal vegetation. The author attributes, in some measure, the return of the disease, after the operation, to some of the younger semina or roots having been left, which, in time, will carry on the propagation of the disease, although the great original mass of mischief be extirpated. So far as the return of the disease is effected in this manner, there does not require the presence of leprous or elephantiasis virus to explain its reproduction, it must equally take place if the cancerous virus is one *sui generis*.

Cancer may affect various parts of the body, and the symptoms and progress will vary according to the part affected. The more slow or rapid progress of the disease, the author thinks, is also influenced by the temperament of the individual; the rapid progress of scirrhous tumours is more particularly remarkable in fair women of a sanguineous temperament, because such are constitutionally subject to inflammation. The disease frequently attacks different individuals in the same family, indicating therefore an hereditary predisposition to it;

while some members of the same family are affected with scrofula, others with lepra or elephantiasis, and others with cancer; whence the author judges, that, in such circumstances, there is a combination of cancer, elephantiasis, and scrofula, in the same family.

Whether the absorption of cancerous matter ever takes place previous to ulceration, is a matter of considerable doubt; nor does the author attempt to determine the question: that absorption does take place after ulceration, is clearly ascertained; the propagation of the disease during its scirrhous state, is attributed by the author to *irritation*, extending from one gland to another, which, even before ulceration, may have occupied so great an extent as to preclude all hopes from an operation. Every tumour, it is observed, apparently of a scirrhous kind, may not be cancerous; but every cancer in its incipient state is truly a scirrhus: this is a distinction of great importance in practice; we have, however, no absolute mark to distinguish, in the most early state, *in all cases*, those scirrhi which are not, from those which are cancerous. The age and temperament, and other circumstances, must be taken into consideration in forming a diagnosis. As a general practical rule, the author thinks it safer to anticipate irritation and diseased action (which, sooner or later, take place in every such gland), when it is *very small and perfectly moveable*, than to suffer it to remain liable to increase, and become irritable from a mere process of nature, as well as from accidents. At the same time he admits, that even a true scirrhus may oftentimes remain quiet for months, and even years. Probably, during this its state of quiescence, it would be advisable to make trial of means to discuss the tumor, which, if not cancerous, might speedily yield; and, in case of its being really cancerous and not yielding, nothing would be lost by the trial; the operation might be had recourse to whenever the tumor should exhibit signs of increase. This method the author has in several instances adopted, and with considerable success. Indeed he has illustrated his opinions by a great number of cases, many of them very interesting and instructive. His directions for the management of scirrhi, in the early stages of the disease, are judicious and important. We shall state some of the most material in the author's own words

"Whatever means are employed to keep quiet a gland diseased from a blow or bruise, in cases where an operation will not be submitted to, the rule of practice of endeavouring to discuss it, or prevent its increase, at an *early period*, holds good. From the time of the accident, it should never be neglected, or left to itself. Applications of a sedative and discutient kind should be had recourse to immediately. Pressure from the stays should be guarded against; the bowels should be kept open, and a cooling regimen enjoined; and it may be necessary to draw blood repeatedly by means of leeches. It is before ulceration takes place, that leeches may be applied, at some distance from the injured part, and afterwards to the part itself. The action of discutients in promoting the absorption of blood extravasated from bruises, is generally quick. If therefore the above means should fail, either to give ease or to remove any hardness that may remain, blisters may be repeatedly applied, which, by stimulating the skin, and producing a considerable serous discharge, will probably prevent the injured part from taking on a diseased action. And where the injury has been neglected, and where at a distant period pain, enlargement, or preternatural fullness has taken place, the like means may be had recourse to, *spatiis catameniorum intermediis*. And, with the same precaution, a warm sea-bath, or even the common warm bath may be employed. The immersion of the body draws the circulation and nervous power to the whole surface of the skin, and increases the sensible and insensible perspiration from the cutaneous glands and pores; it relaxes not only the injured parts, but the system in general; and thus, I conceive, relieves by causing a powerful resolution; but it is very probable that sea-water, as well as some mineral warm baths, the Harrowgate for instance, may have a specific action independent of their operation as warm water."

The author adds, "I am strongly inclined to believe, that a judicious and careful trial of the above plans, when the complaint is not proceeding with rapidity and provided there be time for such treatment, will render even the operation itself more successful should it be resorted to afterwards."

Whatever means are employed, it is of the last importance, as has been before said, that they should be adopted in a very

early stage of the complaint; and so sanguine is the author in his expectations, that he is almost led to believe, that, "*if external and internal means of relief are applied with due discrimination and judgment, sufficiently early, the knife even may be superseded.*" The external applications recommended by the author, in addition to leeches and blisters, are chiefly of the sedative kind; such as the preparations of lead, with which opium may be combined. The nutritum and unguentum tripharmacum of the old dispensatories are highly spoken of by the author; and he has experienced very good effects from a solution of the muriate of ammonia in water. Gentle laxative medicines are to be given internally, and continued for a considerable time; the diet is to be cooling and light, chiefly of the vegetable kind; all stimulants and irritating causes are to be carefully avoided. The author's experience confirms what is but too readily acknowledged, the frequent failure of an operation to effect a cure, even when performed under the most favourable circumstances.

The following interesting case shall close this article.

"Case 43. A married lady, of a thin habit of body, and scrofulous, had one breast removed for a cancer. Within seven months the disease returned, at the cicatrix, and a new tumour arose, but so circumscribed that, in consultation it was determined, the most probable chance for life would be to remove this tumour also. In a short time after the wound of this second operation had healed, a small immovuable hardness arose on the cicatrix, and there were two other small moveable tumours, not bigger than peas, near the axilla. These last, in time, approximated, and the two became one tumour, and like that on the cicatrix, was also fixed. The progress of this last was quicker than the tumour on the cicatrix.

"Great care having been taking to keep the skin whole, by defending it with a mild litharge plaster, an *exudation* only took place for a considerable time, through its pores; that was followed by excoriation, by a yellowish crust or scab, and at length by ulceration. The tumour on the cicatrix followed now the course of the last tumour, and it ulcerated also. There was only an interval of *seven months* from the removal of the breast until the second operation; but there was an interval of nearly

the same number of *years* from the latter to the final termination of the disease. Under the idea that hemlock internally, and Plummer's alterative pills might be of service, she gave a fair trial to both for a considerable time. From the hemlock she derived no advantage. Plummer's alterative mercurial was taken for many weeks, and towards the close of the course, it seemed to have diminished the tumour nearest the axilla; it made no impression, however, on the other tumours, and injured her general health. It rendered her irritable, disposed her to colds and coughs, and laid the foundation of repeated attacks on the chest. When I say that, I believe it did no more than accelerate the kind of pulmonic affection which takes place sooner or later in most cancers of the breast. She often went out during the use of this medicine in inclement weather, contrary to advice.

"The last mentioned tumours, though they finally ulcerated, were at no time larger than a small nutmeg. Other tumours, apparently of the same kind, afterward arose in their neighbourhood, in the skin. Their number was great, though in size small; for she was a thin spare woman. Thus the disease went on, from one gland to another, first hardening, then ulcerating, until the several ulcerations extended to the size of a large dish, reaching not only to the axilla, but to the scapula on that side. In this manner and direction the principal ravages were made, without running on to the sternum and to the other breast. By the constant use of a poultice of boiled carrots, these ulcerations had not only no fetor, but they often looked well, and would heal in one part, whilst they broke out in another. Partly, however, from the constant drain, and partly from repeated attacks on the chest, she got every day weaker, more emaciated, and hectical. Under all these distressing circumstances, the place where there was a tumour, near the axilla, showed not only a disposition to heal, but was so far healed that the tucking down of the skin made a kind of stricture on that part. This, together with other diseased glands in the axilla, produced such a pressure on the lymphatics, nerves, and bloodvessels of the arm on that side, that, from the distension and load, great numbness and pain were at times experienced. The loaded lymphatics might be traced down the arm; and, at certain distances, sup-

puration bursting forth, afforded a temporary relief. The whole extremity, even to the fingers, was not only much swelled, but the skin was in some parts discoloured, from the want of sufficient circulation. The lungs were frequently affected with an asthmatic kind of proxysms, and those affections were attended with cough, with pain in the side, and a sense of stricture and suffocation. These internal symptoms alternated with the painful state of the arm; in proportion as the one part was more violently affected, so was the other relieved; and in this way it went on to its final termination. This person had been subject for years, both before and after the attack of the disease, to violent head-ache, a very distressing vomiting, and bilious affections of the bowels. It is a very interesting case. The second tumour arising on the cicatrix so soon after the removal of the breast, shows that a portion of the disease was left behind, and produced its regeneration; and the rise of the small tumours, after the second operation, points out that there were germs remaining, which were the occasion of others being multiplied to such an extent that the disease ended in death. The whole progress of the tumours demonstrate, in my opinion, a *local glandular sympathy*, and seems to show that there was no absorption of matter into the system from the first and second tumours, nor from the three last before ulceration; and if so, the disease, whilst in such states, may be said to be *local*. If the disease be propagated by a germ, or one diseased gland, it may be like a seed planted in the ground, having a local action where sown, and extending only to a certain space, without influencing the whole of the system."

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Observations sur la Nature et le Traitment de la Phthisie Pulmonaire. Par Antoine Portal, Professeur de Médecine au Collège de France, &c. Edition revue et augmentée par l'Auteur. Avec des Observations et des Remarques par M. Murhy, Docteur en Médecine à Hanovre, &c. qui a traduit cet Ouvrage en Allemand, et avec celles de M. Gaspard Fèdèrigo, Médecin Practisien de Venise, &c. qu'il a traduit en Italien. 2 Tom. 8vo. Paris, 1809.

[From the London Medical Review for January, 1811.]

THE author of these elaborate observations on pulmonary consumption, has been advantageously known to the profession in the different countries of Europe for nearly half a century. He deservedly acquired much reputation for his anatomical abilities, both as a teacher and as a writer; he was moreover the coadjutor of the celebrated Lieutaud in the "Historia Anatomico Medica;" he also enriched the annals of the Academy of Sciences, of which he was a member, with many valuable contributions in a professional capacity. After this respectable institution with all others was suppressed in the beginning of the revolution, having lost his colleagues who withdrew into the country, and his pupils leaving him, for it was now no longer safe to teach, he filled up his leisure in selecting from his notes the remarks that he had made on phthisis pulmonalis, to which disease his attention had been more particularly directed by having been threatened with this complaint. Thus originated these "Observations;" the first edition of which was published in one volume, in the year 1792. The second edition the author has illustrated with the notes of Dr. Murhy, professor of the practice of physic at Hanover, and Dr. Gaspar Federigo, physician at Venice, two of the translators of this valuable performance.

We sit down with no small interest to give the public some account of these volumes, in as much as we consider the subject important almost beyond any other; and because this is the work of a veteran who has laboured with uncommon diligence to establish by the knife an accurate diagnosis. We shall make several extracts from the work, and leave the reader to form his

own judgment of their merit: first, stating the manner in which the author has divided his subject. After a preface and introduction by himself, and a preface by Mr. Murhy, he divides phthisis into fourteen species.

1. The scrofulous phthisis, which he subdivides into hereditary and accidental.
2. The plethoric phthisis.
3. The phthisis that follows inflammation of the lungs.
4. Phthisis that succeeds to eruptive fevers, cutaneous diseases, and metastases arising from them.
5. Catarrhal phthisis.
6. Phthisis succeeding asthma.
7. Arthritic and rheumatic phthisis.
8. On concretions found in the respiratory passages; and on calculous phthisis.
9. Scorbutic phthisis.
10. Syphilitic phthisis.
11. Phthisis succeeding fever.
12. Nervous, hypochondriac and hysteric phthisis.
13. Phthisis the consequence of delivery.
14. Observations on phthisis succeeding contusions and wounds of the breast.

Some general observations on the symptoms of each species, on the duration of the disease, and on the blood of phthisical patients, are then offered. Observations on the dissections, and on the general treatment follow. The work concludes with some reflections on the communication of the lungs with the arm and external parts of the breast. There is also annexed a copious analytical index.

Section first, p. 1.

Scrofulous Phthisis.

"There are two sorts of this phthisis: one hereditary, or acquired in nursing; the other may be induced at any time by occasional causes."

We shall give an instance of that kind of phthisis which is derived from the nurse.

"Dissection 1st. I opened the bodies of three young children belonging to M. Bellinger, counsellor of state, who died

of phthisis; one of them did not spit blood. I found the lungs full of concretions, some of which were corroded, and others fungous; some had the appearance of steatomatous tumours, others were scirrhous. Some were entirely suppurated, the pus that flowed from them, was whitish and clotted; of these a great many were situated in the cellular membrane of the lungs. As to the bronchial bodies,* some appeared in a sound state, others were changed, and they were in the vicinity of glands and lymphatic vessels, which leave me without any doubt that the lymphatic passages are the true seats of the disease. The glands of the mesentery and the upper part of the sides of the neck near the jugular veins, and the glands of the œsophagus were filled with tumours, containing steatomatous matter: the gums and the velum palati were not diseased. The teeth were of shining white. The spine of one of the children was enlarged, and some of the vertebræ were become soft. Mr. Bellenger, who afterwards lost two other children by the same complaint, died of apoplexy and his wife of the dropsy."

Observation 6th, p. 27.

"In the year 1779, I was called by one of my pupils to be present at the opening of the body of a child of three years of age, belonging to M. Rossignols, dealer in iron and copper-wares. He had all the symptoms of phthisis; and his mother died of the same complaint about a year before. In the lungs of this child I observed tubercles, some of which were beginning to suppurate, others were in a state of complete suppuration; some were white and full of a plastry matter. There was an effusion of water in the chest: the mesentery was full of steatomatous concretions. The teeth were of a shining white. The extremities of the clavicles next the sternum were enlarged: the spine was a little awry; its spinous processes, particularly of the back were also enlarged."

In this place, vol. I. p. 42, the question is discussed, whether original or hereditary phthisis be contagious. M. P. is most decidedly of opinion that the disease is not communicable; and his Italian commentator is of the same opinion, although Dr.

* These are the firm roundish white bodies (*corps bronchiques*) about the arches of the bronchia, which we shall have occasion further to notice.

Murhy tells us in a note on the same subject, that the Council of Health at Florence had published an advertisement and rules to prevent this contagion. In answer to this, the author and M. Fèdèrigo quote Anton. Cocchi and Castellani, &c. who entertained the same opinion. For our own parts, we should be glad that it were a more doubtful question: in this country, there can be little risk in declaring that many instances have occurred where the disease has been communicated, and particularly in the dysodic state of the disease.

We shall now produce a case of the accidental phthisis in a scrofulous habit. We lay greater stress on this division of the disease, as we believe it may almost comprehend every sort of tubercular consumption; for notwithstanding the many species of phthisis here treated of and found in nosological writers, yet where tubercles are not concomitant, we cannot consider them true phthisis, but only so many modifications of inflammation of the lungs; and where tubercles are present, true phthisis only acquires the names of the different occasional causes.

Observation 3d, vol. 1. p. 124.

"The countess of Neuperg, of a delicate complexion and about thirty years of age, had two children; her pregnancies and deliveries were always attended with much bodily pain. She came to Paris in the year 1782, and there experienced much sickness, having almost every sort of nervous complaint; such as frequent hiccups, involuntary sneezings, bursts of coughing, spasms, convulsive motions in the muscles of the trunk and of the extremities, difficulty of swallowing from convulsive contraction of the muscles of the pharynx; and for twelve days had not any evacuation of the bowels; at the same time she was harassed with frequent colics and sleepless nights. At last the most urgent nervous symptoms came on, requiring varied and successive courses of diluting and cooling medicines (*humectans et rafraichissans*) both in the form of drinks and of baths, which were the only means that could have succeeded.

"Opiates only increased the irritation; the weakest of which I forebore to administer. Her health improved when she became pregnant. Even then she experienced oppression of the

breast; her difficulty of breathing returned, particularly when going up stairs. Every month about the menstrual period a slight fever came on, her pulse became small, frequent, and hard, with a dry cough almost incessant, particularly in the night. She again made much use of diluents (*humectans*) and cooling medicines, both in drinks and in the form of baths; small but repeated bleedings three or four times during her gestation were found necessary. Towards the seventh month of her pregnancy her husband became involved in misfortunes, in which she feelingly participated; her mind was tortured; she lost her rest; her cough came on; she became hot and in pain from an inflammation of the throat; the axillary glands swelled and became hard. Several enlargements could be seen about the anterior part of the neck and side of the larynx. It was in this state that she brought into the world a living child, very small but well enough proportioned to give expectations of rearing him. The result of her delivery was unfortunate; the lochia were hardly red, and in very small quantity, but in fifteen or twenty days after, a considerable hemorrhage from the uterus took place, and her cough was now become very obstinate, without expectoration. Her throat was ulcerated; she had continued fever with accessions, copious nocturnal sweats, colicky pains, diarrhœa, and lastly an edema of the lower extremities. She retained her faculties to the last, as generally happens in this kind of disease.

"The following were the appearances on opening the body: 1. The brain was perfectly healthy without any accumulation in the bloodvessels. 2. The trachea, the inside of which we carefully examined, was not the least inflamed. The larynx and pharynx with their internal membranes were equally sound. The lungs were suffused (*infiltré*) with a reddish fluid of a bloody appearance. We found in the cellular membrane several whitish concretions, some of which were of a more solid texture; many were in a state of true suppuration. In different parts of the lungs abscesses were found, some of which were insulated, others communicated with one another. The most considerable of these abscesses were situated at the top of the left side of the lungs near the œsophagus, to which it adhered by means of a firm part of the cellular membrane. Lastly the lungs ad-

hered to the pleura and to the diaphragm. 3. The heart was in its natural state. 4. The abdominal viscera were not at all changed, with the exception of the pancreas, the glandular parts of which were larger and harder than they ought to be. 5. The hinder part of the brain and spinal marrow were natural. 6. The velum pendulum palati and the upper part of the pharynx were very red, and covered with vessels filled with blood. There were on the sides of the neck several lymphatic glands of which two were of the size of a small nut, and were hard, and full of steatomatous concretions, with many little sources of purulency; there was in the right cavity of the breast a considerable effusion of sanious serum, which was of the same nature with that which flowed from the lungs."

Of the bronchial bodies, (*corps bronchiques*) already noticed, the following description is given.*

"The bronchial bodies are situated round the bifurcations of the bronchiæ, to which they are united by the cellular membrane in greater or less quantity, and in general the superior bronchial bodies are a little larger than those of the lateral bifurcations of the bronchiæ. In the natural state we observe no excretory canal in these bodies. The cellular membrane with which they are covered, and which enters into their soft and lax texture, the arterial and venous vessels which give numerous ramifications to them; the lymphatic vessels and the nerves which are spread upon their immediate surface and penetrate their structure, as well as the little lymphatic glands which help to make up part of the mass of the bronchial bodies, are so many obstacles to their being discovered, if they really exist."

"I have seen as well as others at different times, the bronchiæ discoloured with a blue blackish fluid, like that which the bronchial bodies contain."

"Independently of these bronchial bodies which we find in the lungs, there are also true lymphatic glands with which many anatomists have confounded them, of a very different nature. They are not like the bronchial bodies which are always placed round the bronchiæ, but scattered without distinction

* Vol. II. p. 306. et seq.

through the substance of the lungs, principally on their external surface. I have seen some of them that were contained in the bronchial bodies, for which they might be easily mistaken, in the same way as we see lymphatics or maxillary glands encircle the parotids. The lymphatic glands of the lungs are smaller than the bronchial bodies: they are more regularly round and harder to the touch."

We confess there is much confusion in M. P.'s description of the bronchial bodies: after giving a tolerably fair view of tubercles or these bodies in the beginning of this paragraph, he immediately confounds them with lymphatic glands, and has even thought he saw a new lymphatic gland which was firmer and rounder than others usually known; and after all ends with his favourite tumefactions or obstructions (*engorgemens.*) In different parts of these observations, we have however proofs that he is acquainted with the most accurate applications of this part of pathology.

These bronchial bodies are in reality the tubercles of Baillie and other eminent anatomists. We are told that he has seen the lymphatic glands in the lungs healthy, when the bronchial bodies were changed, and *vice versa;* and adds, "To return to tubercles, which constitute hereditary or organical phthisis, I think, after the most attentive inquiry, that they are formed by the (*engorgemens*) obstructions of the lymphatic glands spread through almost every part of the lungs, also at a distance from the bronchiæ by lymphatic obstructions of the cellular membrane of the lungs, which after having become more or less enlarged and frequently in a state of suppuration; it is not therefore surprising that we find the lungs of some phthisical patients covered with tubercles."

Another extract from the fifth species, which of all others is probably the most likely to terminate in tuberculous or real phthisis, we may without exceeding our limits be allowed to make.

Catarrhal Phthisis.

"Observation 1st. I knew a woman about thirty years old, who had been very liable to rheums and catarrhs; at last fever came on with spitting of blood, together with a great difficulty

of breathing. She never would consent to be bled; her catamenia were obstructed, and she was seized with a pain of the upper part of her throat; the sound of her voice was at first sharp and then became hoarse. The patient could find no ease in any position; she breathed with equal uneasiness when she was in bed and when she sat up. And only when she held her head a little inclined towards her breast, her respiration became a little more free. Her pulse was small and frequent, and she died after being sick nearly six months, without having experienced either colliquative sweats or diarrhœa. On opening the body, the seat of the disease was found to be the larynx and the trachea. The membrane was of a red colour, and covered with concretions that almost closed a part of the aërial canal; we found two others in the larnyx that were still larger. The substance of the lungs were perfectly sound. The vessels appeared a little more filled with blood than usual, and the right auricle and ventricle were very much distended with blood."*

"Observation 2d. A man of fifty years of age, of a strong constitution, but very often subject to catarrhs and hoarseness, was seized with a continued fever. He coughed frequently, and almost entirely lost his voice. At the beginning of the disease, the expectoration was in great quantity, thick and offensive; on the 14th day of a continued fever, it changed into a tertian. The patient remained twelve days in this state, after which he had a hectic fever and cold shiverings. There was now no longer pain in the chest; the respiration was free; he could sleep with equal ease on each side; the fever diminished, and hopes were entertained of a cure, when the patient's life was suddenly terminated. There was found on the gall-bladder a concretion of the size of a pigeon's egg, without a single drop of fluid bile. The lung on the right side was full of purulent tubercles."†

The dissections are either by M. Portal, or extracted from Morgagni De Sedibus et Causis Morborum or the Historia Anatomico Medica of Lieutaud; they are mentioned by one of his friends to be about sixty-three; they are extremely exact, and must be regarded as very valuable; for though we do not find that appearances are explained in our own manner, or as

* Vol. I. p. 339. † Ib. p. 340.

we should expect from so great a pathological anatomist, we are not disappointed with the work. We have a fund of materials which may perhaps be better employed by others. M. P.'s notions were formed from the humoral pathology of Boerhaave; and his theories have been but little disturbed by intercourse with the medical literature of the day. His practice differs very little from that of the beginning of the last century. By way of example we shall quote his own words in answer to a note of Dr. Murhy, who complains of the feebleness of his practice, and his want of acquaintance with the improvements made in other countries. In reply he says,

"1. That certain juices of plants are tonic, as cresses, scurvy-grass. In place of relaxants (*relachans*) in various cases fox-glove may be ordered in extract, and in the same manner wakerobin, powder of polygala, Virginian snake-root, vesicatories and moxa in cases according to circumstances. Thus French physicians do not, at least I do not, always prescribe (*elachans*) weakening or (*adoucissans*) palliative medicines in phthisis. M. Murhy has had an opportunity of seeing a sufficient proof of it. 3. Has not Mr. Murhy seen that I do not bleed except there are sufficient indications from the fullness and hardness of the pulse, which happens particularly in that sort of phthisis from plethora, and in that preceded by inflammation?

"4. Has not M. Murhy seen that I advise emetics when the tongue is more or less charged, when there are nausea and vomitings, when there are marks of the respiratory passages being oppressed with (*mucus*) phlegm in catarrhous complaints, &c.? And then are there not counter-indications that forbid emetics?

"5. That only the signs of scrofula, syphilis or scurvy determine me to order such medicines as are suited to eradicate the vicious taint, and afterwards to contravene such pulmonary diseases with a diligence proportioned to the urgency of the case.

"6. That I order diaphoretics, sudorifics, and vesicatories &c. at the very first approach of phthisis that may be produced by the disappearance of some particular eruption, or by metastasis: tell me are there any curative means that are not founded on the science of indications, drawn from symptoms even in

the several complaints that we have to contend with: otherwise medicine would be given up to conjecture, and often to the delirium of physicians.

"As to fumigations," mentioned by M. Murhy, "we have very often tried them without advantage, and frequently even to the injury of the patient, especially when we employ gases in too active a state, and fumigations even of water too hot or charged with sharp and stimulant substances. The cow-houses are not much more useful to the unfortunate consumptive patients; all we can do is to be as useful and humane as possible, and not to deprive them of all hopes of relief, for often they continue to have some expectation of a cure whilst physicians order them medicines in which they themselves appear to have confidence."*

A long extract from Dr. Gilchrist's work in recommendation of sailing and sea voyages is given by M. Portal; he also adds his testimony to that of Sydenham, in favour of exercise in phthisis: these measures cannot be too much approved, though in some cases horse exercise may be too late or too irritating. He often speaks of using the cautery, which no doubt may be useful; but we should be glad to substitute warm plasters, blisters, issues or setons, according to circumstances. We do most sincerely recommend this work to the notice of every practitioner in countries where this disease prevails, particularly in this, where we are led to believe that it is on the increase. We should have added some extracts from Drs. Murhy and Fèdèrigo, but we are compelled, on account of the length to which this article has extended, now to bring it to a conclusion.

* Vol. II. p. 428, et seq.

ORIGINAL PAPERS.

An Account of a Case of Inflammation of the Vessel, from Venesection, which terminated fatally.

By N. CHAPMAN, M. D.

In the month of March, 1810, I was requested by Mr. Francis, of this city, to visit his coachman. On inquiring into the case, I learned that three days before, while on a journey, he had been attacked in the evening with slight symptoms of pleurisy, which very readily yielded to a moderate bleeding.

The next morning, he felt for the first time, some degree of pain and tension in the arm in which he had been bled.* But the uneasiness was so trifling, and in other respects he was so well, that he continued on the journey. The exertion of driving, as might have been expected, aggravated exceedingly these affections. Such however, was his anxiety to reach home, that he studiously disguised his real situation, lest he should be left behind; and obstinately persevered, against every remonstrance, to perform his duties as coachman. But on the last day of the journey, overcome by the severity of his sufferings, he reluctantly consented to be placed in the carriage, and was in this way conveyed to the city.

My attendance on him commenced in the night, an hour or two after his arrival. Even at this early stage, the case of my patient presented a very serious aspect. His arm was swelled to perhaps twice its natural size. The pain and inflammation were excessive. By pressure, a copious stream of purulent matter issued from the orifice. I could distinctly trace the enlargement of the vein for several inches. It imparted the sensation of a hard inelastic tube enclosed under the integuments.

But these were not the only untoward circumstances incident to the case. There was also considerable pain in the left side, and a universal soreness pervaded his body. Little or no fever was indicated by the pulse. This was weak, irregular, and quick, of a contracted volume, and rather corded.

* The right arm.

It was more a *disturbed*, than a *febrile* pulse. Certainly, it evinced nothing of an inflammatory diathesis. But though apparently not much, if at all feverish, he was greatly harassed by restlessness and inquietude. The temperature of his body was unequal and fluctuating. When his attention was fixed by conversation addressed directly to him, his mind seemed perfectly rational. But otherwise, he quickly became flighty, talked incoherently, and endeavoured to get out of bed. Whatever were my doubts as to the ultimate event, I entertained none respecting the nature of the complaint, or the causes which had produced it. I was, at once, satisfied that the whole of the existing mischief was attributable to inflammation of the vein, extending probably to the heart, and to the introduction of pus into the blood. To the latter cause, I the more promptly imputed the train of nervous affections, as I had seen phenomena of the same kind induced by the injection of pus, of milk, of oil, of mucilage and other bland fluids, into the veins of different animals.

Nor could I hesitate long as to the practice to be pursued. To subdue the inflammation, and to arrest the pus in its passage to the circulation, were indications too obvious to elude the judgment.

Notwithstanding the feebleness of arterial action, I bled him to the amount of twelve ounces. I suspected a state of depression, and thought it not unlikely that the pulse might rise by depletion. Where so large a vessel was inflamed, and seemingly too, the heart itself, it certainly was not unreasonable to conjecture that the want of diffused excitement was owing to this condition of the system.* But my anticipations were not realised. The bleeding was indeed followed by no very sensible effect.†

I next enveloped completely the arm with a blister from the

* We are indebted to Syddenham for the important fact, that in many instances, there is a *depressed*, in contradistinction to an *exhausted* system, and which is to be aroused not by *stimulation*, but by *depletion*. Brown, who had his *direct* and *indirect* debility, differs from him in maintaining, that each of these states is to be relieved by stimulants properly graduated.

† The blood drawn on this occasion, had no very peculiar appearances. It did not, it is true, separate as it ordinarily does. The serum and crassamentum were commixed, as if slightly stirred together. I could detect no pus in

elbow to the shoulder,* excepting at the puncture which was covered with a small emollient poultice to facilitate the evacuation of the matter. During the night, I ordered, moreover, that he should take, at stated intervals, a solution of salts till it purged him actively.

In the morning, he appeared in some respects to be better. The blister had drawn well, and the pain and swelling were, in consequence considerably reduced. Neither was he so restless or irritable, and his mind had ceased to wander.

When at night, I again called, he was much as he had been at my preceding visit. The swelling of the arm was perhaps somewhat further abated. But in a few hours afterwards, the pain in the side, which at no period had entirely subsided, reverted with violence. It did not however *raise his pulse!*

Convinced, by a variety of considerations, that the pain proceeded from inflammation of the heart, I placed a large blister over the region of that organ. Though relieved by this application, of the pain, I had the mortification of seeing him the succeeding morning in a situation of increased danger and alarm. With a pulse weak, quick and tremulous, he was wild and distracted. I directed that he should lose six or eight ounces of blood, by cups from the neck and temples, and to have a blister put on behind each ear.

It now appeared to me to be literally of vital importance, to intercept the pus in its course to the circulation. I therefore resolved, without delay, to make use of compression, though it seemed still to be forbid by the tumefaction of the limb. A bandage and compress were accordingly applied a short distance above the puncture. But nothing material was gained by these remedies. The swelling of the arm, however, declined, and no inconvenience was experienced from the com-

the blood. There was some little size on the surface, which a hasty and prepossessed observer might have mistaken for purulent matter.

* There is nothing, I believe, in the case of an inflamed vein so efficacious as blisters. They operate promptly and decisively. When I first used them, it was at the suggestion of my own mind, or at least I had not the consciousness of their having been employed before. On reading however, the above case to Dr. Dorsey, he told me that Dr. Physick had introduced the remedy many years ago, and his confidence in it was confirmed by very ample experience.

pression. The pus continued to flow profusely. This was late in the evening. My visit the next morning found him worse. To all the bad symptoms which previously prevailed, were now added some still more inauspicious. The morbid sensibility of his body had become so exquisite that he could not bear the slightest touch, or scarcely the weight of the bed-clothes, without complaining. So sensibly alive was he to every sudden impression, that by opening or shutting the door, or walking across the room, or by a question put to him in a sharp tone of voice, or by a strong glare of light, he would be startled, and sometimes exceedingly agitated.

At this critical juncture, I resorted to the advice of my friend Dr. James, who very obligingly met me in consultation. We agreed to give the camphorated emulsion, in large doses, and to have stimulating injections repeatedly administered. But this treatment was equally unavailing. My patient progressively sunk. Low delirium, cold extremities, tremors of the nerves, and convulsive cough soon supervened. His pulse became hardly perceptible. The pupils of the eye were widely dilated, and his countenance assumed an expression uncommonly haggered, phrensied, and distressed. Desperate as I deemed the case, I did not permit my zeal, or my exertions to be relaxed. By the constant use of the most powerful excitants, such as camphor and opium, the volatile alkali, the spirits of turpentine, ether, wine, and brandy, I protracted his existence for three days longer, without having however, during this interval a single gleam of hope afforded me, by any change, of his recovery.

In reviewing the preceding narrative, the absence of febrile, and general inflammatory action, in every stage of the progress of the case, will be apt to strike us as an anomaly of no easy solution. But, it is not wholly without analogy, and it admits at least of some explanation, on the supposition, of a predominance of nervous irritation. We see in the disease excited by the bite of a rabid animal, little fever or inflammation, but vehement nervous commotions. The virus of certain serpents,*

* This is very strikingly illustrated in the case of the man bit by a rattle snake, which is recorded by Mr. Everard Home, in the Philosophical Transactions of London for 1810, and copied into the first volume of this Journal.

insects, &c. is productive of similar effects. In none of these instances is there fever. The nerves are almost exclusively the "seat and throne" of the affection. It is nevertheless, not a little mysterious that in the present case, where so much local inflammation existed, the system was not brought into sympathy. The individual too, was a subject in whom it was most likely to happen, being in the meridian of life, of a robust frame, and with a temperament ardent and sanguineous. The truth probably is, that in all cases of simple inflammation of the vein where it runs high, a sympathetic inflammatory fever is the consequence, but, if suppuration ensues, and the pus reaches the blood, then inflammation is suppressed, and the nervous system becomes assailed.*

The morning after my patient expired, I made an examination with a view of ascertaining the exact state of things. I exposed the vein from the wrist to the axilla. The external surface of the vessel was in many places inflamed, and especially above the puncture. Betwixt this, and the shoulder, matter had penetrated through the vein by four distinct sinuses, into the neighbouring cellular membrane, forming small abscesses. Two of these sinuses were high up the arm.

I dissected very carefully the parts adjacent to the wound. Directly around it, there was an abscess containing, I presume, a large spoonful of pus mixed with a dark fœtid sanies. Sphacelus had already destroyed a portion of the cellular texture.

* To speak more plainly, may not the powers of the heart, when that organ is directly attacked by inflammation, be so crippled, or paralized as no longer to be capable of supporting febrile action, or general excitement. This hypothesis derives some degree of plausibility from a case which recently occurred in our hospital. My friend, Dr. Hartshorne, who attended the case, informs me, that it was marked by symptoms very closely resembling those of my patient. The arterial system was little affected, but the nerves exceedingly so. On dissection, the heart was found in the highest degree of inflammation, and much coagulable lymph was effused. Whether these symptoms are of sufficiently uniform occurrence to warrant this inference remains to be proved. Carditis, I am aware, is very differently described by nosologists. They give to it the phenomena of violent pneumonia. The fact however is, that it is but very rarely met with as an idiopathic affection, being in a great majority of instances, the result of pneumonic inflammation extending to the heart.

Two minute twigs of the cutaneous nerve, which ran across the vein were divided, but whether by the operation of bleeding, or by the ravages of the diseased process just mentioned, I cannot confidently pronounce.

I next laid open the vein. There was inflammation more or less from a little below the elbow to the final point of my dissection. But no where was it very great. By the appearance of the coat of the vein there was, however, the amplest proof of its having existed in the highest grade. Indeed, this is abundantly shown by the formation of the sinuses, &c. Below and above the orifice for several inches, gangrene had taken place, which was bounded by an extensive erysipelatous blush, and the inner surface of the vessel, within this space, had begun to slough.

The quantity of pus in the cavity of the vein was small. It ought, indeed, to have been stated, that for two or three days prior to his death, the discharge from the orifice had gradually diminished. No disposition whatever was evinced, any where along the canal of the vein, to an adhesion of its sides. My wish to extend the dissection was frustrated. Enough, however, has been brought to light by this partial exposition, to confirm my original notions as to the nature, and causes of this series of extraordinary affections.

In reflecting on the management of the case, I have only to regret having confided too much in compression as a means of promoting adhesion. But surely I shall escape censure for adopting a remedy which had been approved by very high and concurrent authority.* I had never before an opportunity of trying compression, under such circumstances, or of seeing it employed. My conviction now is, that it will rarely succeed. It is confessedly, at all times, difficult to produce a union in tubular or fistulous ulcers, even where pressure can be used. It is yet more so, to effect a coalescence between the opposite surfaces of bloodvessels, because among other obstacles, the coagulable lymph which is the medium of attachment, must in a great measure be swept away by the circulation as fast as it is deposited. It is besides almost im-

* Hunter, Cooper, Abernethy, &c. &c. &c.

practicable to make adequate compression on any one of the veins of the arm, without interrupting the return of the blood. I confess, however, that these speculative objections to the practice have less weight with me, than the melancholy instance of its failure which I witnessed. In the case of my patient the experiment was fairly made. For five days and nights successively, I continued the compression, and with the utmost vigilance to the due regulation of it. Distrusting, therefore, the efficacy of this expedient,* if ever I should meet with a similar case, I would most unquestionably apply *a ligature to the vein.* As far as I know, this suggestion is new, and without the sanction of experience, but, at present, I am unable to perceive any reason to discourage us from the operation. The operation, however, will not often be necessary. It can only be required where suppuration has taken place, and there are grounds for the apprehension that the matter is travelling into the circulation. Cases of this sort are extremely rare. Few at least, have been recorded. I have met, in my researches, with only one, at all analogous.† They have hitherto been contemplated by writers rather as a *possible*, than an *actual* occurrence.‡

Injuries to the veins from bleeding are for the most part,

* Let it not be understood, that I have the temerity to deny that compression has never effected this end. This is not my meaning. I believe, on the contrary, that it has, and may sometimes do it. But still, I am ignorant of any case in which its efficacy has been demonstrated by subsequent dissection, or where, in other words, adhesions were shown to exist *under the point of compression.* Yet, as it is an indisputable fact, that such obstructions of the venal tube do spontaneously arise, I cannot doubt of their being also effected by this artificial contrivance. What I design to inculoate is, that these adhesions, in which ever way brought about, are of a very precarious origin, and so slow of completion, that they ought not to be depended upon in a case of such extreme urgency as an *extensively suppurating vein.*

† This case is related by Mr. John Hunter. In dissecting the arm of a man, he traced a series of adhesions along the course of the vein. But near the axilla, the vein, says he, "had taken on suppuration, beyond which adhesions had not formed, and this had given a free passage for the matter *into the circulation, of which the patient most probably died.*" It is to be regretted, that a case, apparently so interesting, should be so imperfectly detailed.

‡ Mr. Abernethy, in his essay on this subject, tells us, that he had never seen a case of the vein suppurating from venesectiou. But he *can conceive*

attended by only a circumscribed inflammation. The suppurative process seldom ensues. Even when it happens, it is generally limited to the vicinity of the wound, through which the pus is either freely evacuated, or is lodged in the surrounding cellular texture, and the abscess thus formed, may be made by an opening to discharge externally, if, contrary to the ordinary course, it does not do it spontaneously.

Philadelphia, November 1, 1811.

A new and expeditious Mode of preparing Phosphuret of Lime.

By EDWARD CUTBUSH, M. D.

CHEMISTS, in preparing the phosphuret of lime, usually adopt the process recommended by Dr. Pearson, or that of Van Mons; in the former, a glass or porcelain tube is used, closed at one end, into which one part of phosphorus is introduced and five parts of lime, in small pieces, the lime and phosphorus being kept in separate parts of the tube. The tube is then placed horizontally among burning coals, so that the part which contains the lime, may be brought to a red heat, while the bottom of the tube, containing the phosphorus, is not exposed to the action of the fire. When the lime becomes red hot, that part of the tube which contains the phosphorus is exposed to a red heat. The phosphorus is volatilized, and passing through the hot lime, combines with it, and forms the phosphuret: a chalk stopper is also used to prevent the access of air.

one, in which it might even be proper to divide the vessel to prevent the pus from entering the circulation. With the greatest deference to the authority of this most distinguished surgeon, I cannot help giving a preference to the ligature in those cases. It has all the advantages of the operation which he prefers, and is exempt from the hemorrhage and other inconveniences which might attend it. Nor does Mr. Charles Bell, another surgeon of great eminence and experience, appear to have met with such a case. Treating, in his system of operative surgery, of suppurating veins, he says, "the danger here is *conceived* to arise from the matter formed within the veins being carried into the circulation," &c. In fine, all the writers whom I have consulted hold the same sort of language upon this subject.

In the process by Van Mons, *carbonate* of lime is put into a small glass matrass, one third of the vessel being left empty; this is placed in a sand bath and exposed to a sufficient degree of heat to expel the carbonic acid; towards the end of the process, a third part of phosphorus is gradually introduced, care being taken to keep the lime in a red heat. The phosphorus melts, but is prevented from burning, by the remains of the carbonic acid which is disengaged from the lime. The matrass is closed with a stopper after the whole of the phosphorus has been introduced; the stopper is provided with *a valve* to let gas escape, but permitting none to enter; the fire is then to be withdrawn: when the matrass is quite cold, the phosphuret is taken out and preserved.*

The process which I propose, and which I have adopted in two instances with success, consists in putting a portion of lime, divided into small pieces, into a Hessian *crucible*, and exposing it in a common furnace, or even in a chaffing-dish of coals, until the lime becomes red hot. The quantity of phosphorus intended to be used, being dried by means of spongy paper, is then put into another *crucible*, sufficiently capacious to contain the quantity of lime to be converted into a phosphuret. Being thus arranged, the ignited lime is *removed* from the furnace and placed in the crucible containing the phosphorus, which is to be expeditiously covered with an inverted crucible sufficiently large to receive that which now holds the lime and phosphorus, care being taken to prevent the access of atmospheric air, by surrounding the edge of the inverted crucible, in contact with the brick or tile on which it rests, with some soft clay or lute: or, a *cover* might be formed to fit the *crucible, containing the lime and phosphorus*, which could be more expeditiously managed. When the contents have remained a sufficient time to become cold, a *phosphuret of lime* will be found to have been formed. In this process, the phosphorus is volatilized by the heated lime, and combines in part with it, forming a phosphuret of lime, which, when thrown into water, produces the same phenomena as that prepared according to the process of Dr. Pearson.

* Journal de Chemié.

The phosphuret made by this process is of different hues, from a dark chocolate colour to that of a pink: a portion thrown into water continued to act three hours: the water, into which it had been thrown, when filtrated, emitted an alliaceous odour, and converted vegetable blues into green, in consequence of the lime held in solution. A small portion of phosphate of lime appeared also to have been formed. The interior parts of the crucible, which was inverted over that which contained the lime and phosphorus, were found covered with a light flocculent powder of a lively red, inclining to an orange colour. Three grains of this powder, put into three drachms of distilled water, communicated no colour to it, but was perfectly transparent on being passed through a filtre; on adding the tincture of cabbage, it became red, indicating the presence of an acid, which must be considered as *a portion* of phosphorus acidified by the oxigen of the atmospheric air contained in the inverted crucible. The powder which had been thus treated, preserved its colour. Can this orange-red powder be considered the phosphuret of carbon of Proust?* It may be inflamed by friction or the application of any ignited substance.

The preceding method of making phosphuret of lime, I consider more economical and expeditious than the processes of Van Mons, and Dr. Pearson.

Philadelphia, December 14, 1811.

* Since the above was written, I have tested this powder by inflaming a portion of it in oxigen gas; a small quantity of phosphoric acid was formed, the remaining gas being passed into lime-water, on agitation, produced a turbid appearance, indicative of the formation of carbonic acid by the union of the carbon of the phosphuret with oxigen. E. C.

Biographical Sketch of Dr. Willis.

[From the Edinburgh Medical and Surgical Journal for April, 1808.]

AMONG the various plans for the improvement of medicine which may be expected to arise in those countries which have arrived at a high state of civilization, such as relate to the treatment of insanity are, unquestionably, the most important. If the progress towards an accurate knowledge of the diseases of the mind kept pace with the number of cases, the philanthropist might calmly sit by and observe with growing satisfaction the advancement of the healing art to those degrees of perfection of which it seems to be capable. But, unfortunately, extreme refinement in the modes of practice has a contrary tendency: the treatment of maniacs is too often abandoned to the keepers of houses of confinement; and the desire of making money is too apt to extinguish that cordial interest which physicians ought to feel for the welfare of their patients; while the indolent occupation of prescribing for frivolous complaints, and the glittering trappings of wealth dazzle and corrupt those who seek them. To produce, in every lunatic, associations and habits which will enable them to perform the business of their respective stations, is the only treatment that can properly be called medical, and the more widely this mode of treatment is diffused, the more successful will our practice become. With the view of making known how much can be accomplished by well-directed efforts in cases of mental derangement, we have collected the following scanty particulars of the life of a man justly celebrated for his skill and success in that line.

Francis Willis, M. A. and M. D. was born in 1717, and died in the month of December 1807, in the 90th year of his age. He was a clergyman as well as a physician, though he devoted his attention almost exclusively to the treatment of insanity. He was a remarkably active, hale, and good-looking man; and about five years before his death, he rode ninety miles on horseback in one day, to give his vote at an election. He had been indisposed some weeks; but the day before he died he was well enough to walk twice to a neighbouring vil-

lage, at the distance of nearly a mile, to visit a patient, and the next day he continued without any apparent change of health till after dinner, when he complained suddenly of being very ill, and five minutes after expired in his chair.

He was of Brazen-nose College, Oxford, M. A. 1740, B. and D. M. 1759. He has left five sons by his first wife, one of whom has long assisted him in his establishment for lunatics. Dr. Willis acquired great celebrity both in this country and throughout Europe, for his skill in curing insanity. In consequence of the fame he acquired by his attendance upon our sovereign, his assistance was sought for by the queen of Portugal; he went to Lisbon, and had that royal personage for some months under his care, but without much success. Switzerland used to send many patients, especially the town of Geneva, where the comparative opulence of the people probably contributed to furnish the doctor with more patients, and their connexion with England might render his reputation more familiar than in other parts of the continent. Persons who have been restored to their families and friends in different parts of the world, all speak with strong feelings of gratitude and respect, of the kind treatment they received, and the relief they experienced, from their amiable and benevolent physician. One elderly lady, who had been for some time under Dr. Willis's care, and recovered, though she continued subject to occasional fits of insanity, requested to reside in his house, because she was so happy in his company, and was so confident of receiving the best assistance in case she had any relapse.

Dr. Willis lived at Greatford, in Lincolnshire, and he there had one of the largest private establishments in the kingdom for the reception of lunatics. His house was pleasantly situated, with grounds and plantations neatly laid out around it, where his patients could enjoy salutary exercise, and have interesting natural objects continually before their eyes. Some of those entrusted to his care were distributed in the neighbouring villages, with proper attendants to wait upon them and overlook their conduct. An asylum in the country is much more adapted "to heal the wounded spirit," and to correct the morbid trains of thought, than a crowded hospital in the midst of a large town. The calm retreat, the multitude of agreeable ob-

jects, the kind and benign aspect of the physician, his constant superintendence, the select society of strangers in similar circumstances, the fear of being put to shame, must all have a favourable effect in promoting the cure. Dr. Willis never published any account of his method; but from what he declared upon a memorable occasion, when the question of a regency was warmly discussed, when he distinguished himself by the manly and bold avowal of his opinion, by giving a favourable prognosis with regard to his majesty's illness, it appears, that of a very great number of persons afflicted with mental derangement, nine out of ten recovered, particularly those who had been placed under his care within three months after they had begun to be afflicted with the disorder. This statement, however, has been declared incorrect, as far as it relates to the precise number of cases, for, in some kinds of insanity, the proportion of cured is greater, in others it is less.

From what can be gathered from the few sources of information to which we have access, the patients at Greatford were treated like human beings; they were managed like children, and not shut up or chained down like wild beasts. Moral means were principally trusted to, yet physical ones were never neglected. The patients were taught to fear and to love their physician; they were admitted to breakfast and dine with him, and in the company of others, as long as they behaved well, and could restrain their feelings; whenever any one transgressed the rules of good behaviour, the strait-waistcoat was employed as the badge of disgrace. No chains or bandages were ever made use of, and the strait-waistcoat only in cases of extreme necessity. One of the principal means he employed was to have the attendants or keepers always appear as servants to the lunatics, appointed to wait upon them and to supply all their wants; but these servants were under the control, and received instructions from their master, the physician, which they dared not, on any account, disobey, and they could not allow any orders to be infringed against without permission. Besides relieving the attendants from a disagreeable situation, this served to give the patients a very high idea of the power of their physician, of whom they never can be brought to think too highly: they ought to feel that their fate rests in his hands,

and that no person in the world is of greater consequence than he who has the management of their health.

Of physical remedies, emetics were most preferred by Dr. Willis. Opium, he thought, did harm; and when narcotics were required, he employed hyosciamus. Blisters on the neck he found hurtful. When the strength of the body wanted to be increased, he gave the Peruvian bark, and he used this in large quantities. Digitalis was considered serviceable in some cases. Dr. Joseph Frank learnt thus much in conversation with Dr. John Willis, and one other fact, which is of some importance, viz. that Dr. Willis had never observed any thing peculiar in the formation of the skull among his patients.—(*Vide Reise nach London, 2ter Band.*)

Various objections are raised against sending a madman to a place of confinement, even among the highest and lowest classes of society. A principal one is the fear of severe and cruel treatment, and the hazard of making the disorder permanent; but these apprehensions are groundless; for there must be some grievous defect in the mode of correcting the disordered mind, if correct sentiments and rational and orderly behaviour are not inculcated by the habit of self-denial, and strong efforts of the will. Let the appeal be fairly made, by visiting a maniac at his own house, or at a large establishment appropriated for the reception of such persons. Patients in bedlam are, in general, not only more orderly, but more rational and tractable than those in a private house, where the continual fluctuations of temper and apprehension among friends, lead alternately to improper indulgence or undue severity. Such treatment will both confirm the morbid associations, and enervate the natural character, just as sullenness and ill-humour are the natural consequences of irregularity and inattention in the early part of life. If great advantages are derived from lunatic hospitals, (imperfect as they have hitherto been, and little as their managers in general understand the art of forming the characters of their patients), how beneficial may they become under the direction of a benevolent physician, who, instead of confining his efforts merely to make the noisy quiet, and the sullen to eat and speak, labours with redoubled attention to rectify the disorders of the several powers of the mind, to ex-

cite its healthy action, and by the fine, yet simple contrivance of making a society or school of their own, exhibits the interesting sight of the melancholic gaining health and spirits, and the maniac restored to take his station again in the extensive society of the world? Such seems to have been the plan of the late Dr. Willis, and the number of those who have recovered under his care, will best testify how well he reduced such a plan to practice.

MEDICAL INTELLIGENCE.

Process for dissolving Gum Elastic in Æther.

[From the Medical and Physical Journal for November, 1811.]

A pound of vitriolic æther is put into a bottle capable of containing about four pounds of any common liquid. On this æther there are poured two pounds of pure water, the bottle is then stopped, held with the mouth downwards, and strongly shaken, in order to mix them. On discontinuing the agitation, the æther soon swims uppermost; the bottle is still held in the same position, and cautiously opened, keeping the thumb on the mouth of it. The water is by this means easily let off, and collected in a vessel below.

This operation is repeated two or three times with new quantities of water, until the sixteen ounces of æther are reduced to about five ounces. It is this purified remainder that is found to be the most perfect solvent of elastic gum, which is thrown into the æther after being cut into small pieces. It begins to swell in a very short time; the æther penetrates it, and appears to act slowly on it at first, but at the end of five or six hours, or later, the liquor is saturated and remains transparent. If there be a surplus of the gum it falls to the bottom, and on being removed from the bottle may be moulded into any form and will preserve its elasticity.

Having now described the manner of dissolving this curious substance, I shall add the most simple method of applying the part completely dissolved to use. A tube may be made

in the following manner: Prepare a small cylinder of pipe-clay of the diameter and length of the intended tube. It is unnecessary to bake it, but sufficient merely to dry it. The æther saturated with the gum is poured into a glass or tin cylinder a little larger than the clay rod, and filled up to the brim with the said liquor. The operator then plunges the clay pipe into the æther, withdraws it suddenly and allows it to remain for an instant in the air, replunges it anew, and repeats the operation in proportion to the intended thickness of the tube, as each immersion leaves a small coating. The tube being thus formed of the elastic gum, is thrown into water in order to dissolve the clay pipe. This the water very soon effects, and the gum is left in the form of a perfect tube.

By a similar process to the above, elastic bottles, &c. may be formed of any size or dimensions.

There have been admitted into the Lying-in Hospital at Paris, (Maison d'Accouchemens) between the 9th of Dec. 1799, and the 31st of May 1809, 17,308 women, who gave birth to 17,499 children; 189 of them have been delivered of twins, and two only of three children. The proportion of twin cases to single births is 1 to 91.

Two thousand of these women were affected afterwards with illness, or some serious accident; 700 died out of the 2000.

Of the 17,499 births, 16,286 were presentations of the *vertex* to the *os uteri.*

No.		Proportions.	
215	were presentations of the feet	1 to	$81\frac{2}{3}$
296	the breech	1 —	$59\frac{1}{9}$
59	the face	1 —	$296\frac{1}{2}$
52	one of the shoulders	1 —	$336\frac{1}{2}$
4	the side of the thorax	1 —	$4374\frac{3}{4}$
4	the hip	1 —	$4374\frac{3}{4}$
4	the left side of the head	1 —	$4374\frac{3}{4}$
4	the knees	1 —	$4374\frac{3}{4}$
4	the head, an arm, and the cord . . .	1 —	$4374\frac{3}{4}$
3	the belly	1 —	5833
3	the back	1 —	5833

3	the loins	1 to	5833
1	the occipital region	1 —	17499
1	the side, with the right hand	1 —	17499
1	the right hand and left foot	1 —	17499
1	the head, and the feet	1 —	17499
2	the head, the hand, and forearm . .	1 —	8749½
37	the head and umbilical cord	1 —	473

Of this great number of women 230 were delivered by art, the rest were natural births, being in the proportion of 1 to 76½; 161 were delivered by the hand alone, the children being brought by the feet; 49 were delivered by the forceps, either on account of the small dimensions of the pelvis, the falling down of the umbilical cord, or the wrong position of the head, when the woman was exhausted, or her life was in danger by convulsions, &c.; 13 were extracted by the crotchet after perforation of the head, on account of mal-conformation of the pelvis; in these instances the death of the child was first ascertained.

The cesarian operation was performed in two cases, the diameter of the pelvis being only one inch six lines from sacrum to pubis.

In one, the section of the symphisis pubis was performed, the diameter of the pelvis from sacrum to pubis being only two inches and a quarter.

Gastrotomy was performed once, the fœtus being extra uterine; the child weighed 8lb. 2oz.

FRENCH NATIONAL INSTITUTE.

Abstract of the Report of the National Institute at Paris for the year 1810.

Messrs. Gay-Lussac and Thenard have directed their attention to compare the relative powers and energies of different Galvanic piles. They have discovered that the force of the pile is not increased in proportion to the number of plates. To produce a double effect, the number of plates must be increased eight times. In general, it was found that the quantity of gas the piles will produce, is nearly in proportion to the cube root of the number of plates employed.—Amongst the discoveries

to which the Galvanic pile has given rise, there are few more interesting to general chemistry than the transformation of the alkalies into combustible substances of metallic splendour.

This transformation, first discovered by Mr. Davy, was afterwards doubted by Messrs. Gay-Lussac and Thenard. In their former report they were disposed to consider potassium and sodium as combinations of the alkalies with hydrogen, and to class them amongst the compound substances called hydrurets: subsequent experiments have led them to incline to the opinion of Mr. Davy, and to regard potassium and sodium as simple metallic substances.

M. Berthollet has communicated a process for making the muriate of mercury, called mercurius dulcis or calomel, by passing oxygenated muriatic gas through mercury; it combines rapidly with the metal, and forms with it the muriate of mercury; and as this metallic salt has a perfect analogy with other mercurial salts produced by other acids and mercury at the minimum of oxidation, he concludes that the mercury, in forming this combination, has been reduced to an oxide by the oxygen of the acid, and not by that of the water.

M. Guyton has directed his attention to the mode of giving a permanent red to glass, by means of copper, which by accident he first discovered might be done. M. Sage has also taken a part in these experiments, with the intent to colour glass red by means of copper and the phosphate of lime, or with bones; and he has shown crystals of glass, from the bottom of the pots used to melt glass in the bottle manufacture at Seves, which had some resemblance to hexaëdral prisms. It is well known that simple means have been discovered to extract soda from common salt. France formerly imported this article, so necessary to the arts: an inconvenience attended the mode of preparing it, from the quantity of acid gas which escaped, and was highly injurious. Amongst the different means of preventing this inconvenience which have been attempted, that of M. Pelletan the younger is deserving of notice. It consists in making the muriatic gas pass through long horizontal tubes partly filled with calcareous earth, which absorbs the gas, forming with it the muriate of lime. The experiments of M. Sage on plumbago (black lead) show that this substance does not contain any

iron, but consists of a coaly matter mixed with one tenth part of clay. The fossil carbon of St. Symphorien, near Lyons, approaches nearer to this substance than any other known mineral.

M. Deyeux has presented to the class of agriculture a loaf of sugar made from the red beet (*betterave*), which had all the whiteness and flavour of the sugar from the cane. He has announced that this substance may be made in great quantities by the proprietors, who have devoted to this attempt 400 acres of ground. Should it succeed on the great scale, it will change the relations of the two worlds.

Letter from the National Vaccine Board to the Governors of the Finsbury Dispensary, London, on the bad effects of the practice of inoculating for the Small-Pox, at that Charity.

SIR, Leicester Square, Oct. 25, 1810.

As the Finsbury Dispensary was instituted from the purest motives of charity and benevolence, it is conceived, that you and the other governors will approve of a communication, intimating, that the practice of the dispensary in one point is producing effects the reverse of your intention.

It is scarcely requisite to inform you that parliament, after fully examining into the merits of the discovery of vaccination, were convinced of the important benefits that would result from its general adoption; and parliament, in consequence, have authorised Government to form a National Vaccine Establishment, in order to extend vaccination to all parts of the empire.

This establishment is placed under the control of the president and censors, and the master and governors of the royal colleges of physicians and surgeons of London; who, from experience, and authentic information, are fully persuaded of the wisdom of the practice of vaccination, and of the futility of those objections which have been urged against it. They observe, however, with regret, that although vaccination has spread not only through the British empire, but also among foreign nations, with the most beneficial consequences, yet from prejudices artfully kept up, small-pox inoculation is still prevalent among the poor of this metropolis.

About two years ago, the governors of the smallpox hospital took this business into consideration, and from a conviction of the great mortality which was caused by propagating a contagious and fatal disease, they prohibited their medical officers from inoculating for the smallpox, or distributing smallpox matter.

A decrease of deaths from the small-pox was the immediate consequence: but unhappily, this fatal malady again rages through the town, and destroys, within the bills of mortality alone, about thirty persons every week.

Upon investigating the sources of this direful pestilence, I have learnt, that besides the pernicious activity of certain private practitioners, the inoculation of smallpox is extensively carried on at the Finsbury Dispensary; above a thousand persons having been inoculated there last year, and matter having been distributed for the inoculation of others to an unknown extent.

You are earnestly requested to reflect upon the consequences of thus diffusing among the crowded lanes, courts, and alleys of this populous city, a baneful infection, which proves fatal to multitudes, and strikes many with total blindness.

These indisputable facts made an irresistible impression upon the minds of the governors of the small-pox hospital; and as they knew that the inoculation of the small-pox was disapproved of by the most eminent of the medical profession, they were little affected by the misrepresentations of the prejudiced, or by the sophistry of a few who are interested in the propagation of small-pox.

It is to be presumed that when the governors of the Finsbury Dispensary deliberate upon this subject, they will decide with equal prudence and humanity. For they are at present, though no doubt unintentionally, opposing a most benevolent measure of parliament; and sanctioning a practice most fatally injurious to the community. I have the honour to be, &c,

JAMES MOORE, Director.

Extract of a letter from Dr. Seaman, of New York, to one of the Editors, dated 2d mo. 2d, 1812.

"We have had a pretty full opportunity in our hospital of testing the efficacy of the muriate of gold, as a remedy in syphilis, according to the recommendation of Dr. Chrestien; and it really appears to be a valuable discovery. Many cases have been cured by it alone, and apparently as readily and effectually as by mercury, while it produces no disagreeable or dangerous effects upon the system; no evident operation upon the secretions, excepting the increased discharge of urine, and this does not take place uniformly. In a great proportion of the cases it seems to act like a charm, its only evident effect being that of curing the disease."

PHILADELPHIA DISPENSARY.

Managers, elected January 1812.

William White,	Robert Ralston,
Lawrence Seckel,	Ebenezer Hazard,
Robert Blackwell,	Isaac Snowden,
Henry Helmuth,	Joseph Crukshank,
Robert Smith,	Elliston Perot,
Godfrey Haga,	Samuel P. Griffitts.

Officers, elected January 1812.

ATTENDING PHYSICIANS AND SURGEONS.

Doctor Joseph Parrish,
Isaac Cleaver.
John Perkin,
Henry Neill,
Samuel Stewart,
George S. Schott.

CONSULTING PHYSICIANS AND SURGEONS.

Doctor Benjamin Rush,
Thomas Parke,
Caspar Wistar,
Philip S. Physick.

TREASURER.

John Clifford.

APOTHECARY.

George G. Tresse.

HUMANE SOCIETY.

Managers, &c. elected March 1812.

Joseph Crukshank, *President.*
Isaac Snowden, *Secretary.*
Willam Leedom, John Bacon, } *Inspectors of the Apparatus.*
Samuel P. Griffitts, Thomas C. James, Joseph Parrish, } *Committee of Correspondence.*
Charles Marshall,
Samuel Pancoast, jun.
Benjamin Thaw,
Charles Penrose,
Matthew L. Bevan,
Joseph P. Horner, *Treasurer.*

THREE cases have lately occurred in Guy's Hospital, in which the external iliac artery has been tied with complete success, for the cure of inguinal aneurism. In one case the tumor was in a state of mortification at the time of the operation. The coagulum was discharged, and the patient is daily regaining the use of his limb. This is the fourth time the operation has been performed in that hospital, and all the patients are at this time alive and doing well. In two of them, mortification had taken place upon the tumors at the time of the operation. *Lond. Med. Review, July* 1812.

From a letter from A. Pearson, to the editors of the London Medical and Physical Journal, dated Canton, March 23, 1811, it appears that the practice of vaccination had been carried on extensively to that date, both there and at Macoa, during the ravages of the smallpox, (the visits of which are in that country annual), but when the immediate danger past over it had been so much slighted as to render the preservation of the virus difficult. "Indeed," says the writer, "from August 1810, to "January 1811, we were entirely without it at both places; "and when in consequence of the reappearance of the small-

"pox, applicants for vaccination became numerous, I had the "satisfaction to find that it had been kept up in a district at "some distance from hence *by a Chinese* whom I had in- "structed, and of receiving from that quarter a fresh stock, "from which the practice is now amply kept up here, and has "been revived at Macao." *Lond. Med. and Phys. Journal, December* 1811.

From the tables of the deaths by smallpox in London, in the twelve years preceding the practice of vaccination, and in the twelve years immediately succeeding the introduction of that process, (that is, from 1787 to 1810 inclusive), it appears that,

The total number of deaths by smallpox, in the first twelve years, amounts to - - - - -	22,170
Ditto in the second twelve years, or subsequent to the introduction of vaccination, - - - - -	17,122
The excess of number of deaths in the first term of twelve years, - - - - - - -	5,048

That is, about four hundred and twenty persons per annum fewer for twelve years died since, than before vaccination. *Ibid.*

The operation for the varicose *vena saphena major* has very lately received considerable improvement. The mode of operating formerly employed was too frequently followed by fatal results. The present method, the improvement of which consists in removing the ligature from the vein in a few minutes after its application, we are assured, is always effectual to obliterate the canal of the vessel, and has not yet been succeeded by any untoward circumstance. We are informed that Mr. Freer, of Birmingham, has employed the operation thus modified, several times with complete success. *Ibid.*

Hufeland has lately recommended belladonna in whooping-cough. It has often produced favourable effects in a few days in cases even where opium and musk had been inefficacious. The dose for children, from three to six years, is one fourth of a grain, night and morning; in some cases, the dose may be increased and repeated oftener. *Ibid.*

OBITUARY.

Died, at Kingston, (Jamaica,) T. DANCER, M. D. author of various medical works.

—— at Gloucester, (England,) aftera few days' severe illness, CHARLES BRANDON TRYE, Esq. F. R. S. and senior surgeon to the Glocester infirmary, and author of several interesting works on medicine and surgery.

—— at New York, March 1812, EDWARD MILLER, M. D. in the fifty-second year of his age. He was a native of the state of Delaware, where he practised as a physician; after retiring, at the close of the war, from a situation in the hospital department of the United States, in which his youthful zeal had engaged him. About fifteen years since, he removed to the capital of the state of New York, leaving behind him a character for talents and humanity, which had endeared him to his own state. At New York he continued his professional career with increased ardor and success; not solely confining himself to the practice of his profession, but embarking in literary works for the advancement of medical knowledge, which claim a high rank in science.

With the aid of Dr. Mitchell, he conducted the Medical Repository; a publication whose character is too well known to need a notice of it here.

His rank as a physician had entitled him to the confidence and reward of his adopted state; and he filled, at the period of his decease, the office of resident physician for the port of New York.

FOR THE ECLECTIC REPERTORY.

Statement of Deaths, with the diseases and ages, in the City and Liberties of Philadelphia, from the 1*st of January* 1811, *to the* 1*st of January* 1812.

DISEASES.	Under 1 year	From 1 to 2	From 2 to 5	From 5 to 10	From 10 to 20	From 20 to 30	From 30 to 40	From 40 to 50	From 50 to 60	From 60 to 70	From 70 to 80	From 80 to 90	From 90 to 100	From 100 to 110	Ages unknown	Total
Abortion	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Angina Pectoris	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Asthma	0	0	1	1	0	0	0	1	2	2	0	1	0	0	0	8
Abscess	1	1	1	1	1	3	2	1	2	1	1	0	0	0	0	15
Aneurism	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Apoplexy	0	0	1	1	1	4	10	10	9	4	4	2	0	0	0	46
Atrophy	3	3	0	0	1	0	0	2	3	2	0	0	0	0	0	14
Burns	2	1	4	0	0	1	2	1	0	1	0	0	0	0	0	12
Cancer	0	0	0	0	0	2	0	3	5	0	2	0	0	0	0	12
Caries of the Spine	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Casualties	2	1	0	3	3	1	4	1	1	0	0	0	0	0	0	16
Catarrh	5	1	0	0	0	2	1	0	0	1	0	0	0	0	0	10
Child Bed	0	0	0	0	0	2	1	2	0	0	0	0	0	0	0	5
Cholera Morbus	147	51	24	1	1	3	3	1	0	0	0	0	0	0	9	240
Cholic	0	0	0	0	0	0	3	3	3	0	2	0	0	0	0	11
Consumption of Lungs	9	6	4	8	20	99	74	54	32	16	12	0	0	0	35	369
Convulsions	104	12	13	5	0	7	3	0	3	0	0	0	0	0	15	162
Chicken Pox	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Decay	11	4	4	2	2	8	5	8	6	8	5	2	0	0	21	86
Diarrhœa	2	1	1	1	0	6	8	4	1	7	4	0	0	0	0	35
Dropsy	3	1	5	1	3	11	13	13	11	8	5	1	0	0	0	75
of the Breast	2	1	0	2	4	1	4	5	12	2	2	0	0	0	0	35
in the Brain	14	12	6	2	1	2	0	0	0	0	0	0	0	0	10	47
Drowned	0	0	0	2	4	2	17	6	1	0	0	1	0	0	0	33
Dysentery	2	7	7	1	1	3	2	5	8	5	6	0	1	0	0	48
Drunkenness	0	0	0	0	0	3	3	0	1	1	0	0	0	0	0	8
Diseases in knee joint	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Debility	11	1	3	1	1	3	5	2	7	5	8	1	0	0	15	63
Epilepsy	0	0	0	1	3	4	2	0	1	0	0	0	0	0	0	11
Eruptions	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Erysipelas	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Fracture	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Fever	8	3	3	1	1	9	3	0	2	1	0	1	0	0	0	32
Intermittent	2	0	0	0	0	1	1	1	0	0	0	0	0	0	0	5
Remittent	0	1	2	1	3	4	1	0	1	1	0	0	0	0	0	14
Bilious	0	1	2	4	1	6	1	7	0	1	0	0	0	0	0	23
Nervous	1	0	2	0	2	2	0	2	1	0	0	1	0	0	0	11
Malignant	0	0	1	0	2	1	1	0	0	0	0	0	0	0	0	5
Typhus	0	0	2	3	7	7	10	9	4	1	0	0	0	0	0	43
Puerperal	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4
Hectic	0	0	1	1	0	0	3	0	1	0	0	0	0	0	0	6
Scarlet	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	3
Inflammatory	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	4
Mortification and Gangrene	5	2	2	0	2	3	4	3	1	1	0	0	0	0	0	23
Gout	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	4
Gravel	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
Carried over,	341	114	91	44	65	208	191	145	118	72	51	10	1	0	105	1553

DISEASES.	Under 1 year	From 1 to 2	From 2 to 5	From 5 to 10	From 10 to 20	From 20 to 30	From 30 to 40	From 40 to 50	From 50 to 60	From 60 to 70	From 70 to 80	From 80 to 90	From 90 to 100	From 100 to 110	Ages unknown	Total
Brought forward,	341	114	91	44	65	208	191	145	118	72	51	10	1	0	115	1[illegible]8
Hooping Cough	15	19	16	2	1	1	0	0	0	0	0	0	0	0	0	54
Hives	28	3	8	1	0	0	0	0	0	0	0	0	0	0	0	40
Hernia	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Hemorrhage	1	1	0	0	2	3	1	0	0	0	0	0	0	0	0	8
Hydrophobia	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Inflammation of the Brain	2	0	1	1	0	3	5	1	1	0	0	0	0	0	0	14
of the Lungs	4	0	0	2	1	1	1	0	1	0	0	0	0	0	0	10
of the Stomach	1	1	2	0	3	3	2	5	1	0	0	0	0	0	0	18
of the Bowels	3	2	4	4	2	5	2	0	2	3	0	0	0	0	0	27
of the Liver	1	1	0	2	0	4	5	9	2	2	0	0	0	0	0	26
Insanity	0	0	0	0	0	5	14	11	1	1	0	0	0	0	0	32
Jaundice	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	3
Locked Jaw	0	0	0	1	2	2	2	1	0	0	0	0	0	0	0	8
Measles	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Old Age	0	0	0	0	0	0	0	0	0	1	13	16	10	4	0	44
Pleurisy	6	4	2	2	9	12	12	5	8	5	2	0	0	0	0	67
Palsy	0	0	0	0	0	0	3	3	8	3	10	1	0	0	0	28
Rheumatism	0	1	0	0	0	1	4	1	0	2	0	0	0	0	0	9
Rupture	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	4
Scrofula	2	4	2	0	1	3	2	1	0	0	1	0	0	0	0	16
Sore Throat	11	4	4	1	0	0	1	1	0	0	0	0	0	0	0	22
Small Pox natural	18	20	21	11	10	13	6	0	3	0	1	0	0	0	10	113
Inoculated	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	4
Still Born	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137
Suicide	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2
Sudden	0	1	0	0	1	11	29	11	2	0	0	0	0	0	0	55
Syphilis	2	0	0	0	1	2	1	0	0	0	0	0	0	0	0	6
Teething	8	9	3	0	0	0	0	0	0	0	0	0	0	0	0	20
Thrush	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ulcers	2	0	1	1	1	1	0	2	1	0	1	0	0	0	0	10
Worms	0	3	6	3	0	0	0	0	0	0	0	0	0	0	0	12
Unknown	5	1	0	1	1	0	8	11	8	4	0	0	0	0	0	39
Total,	588	188	164	77	101	281	290	208	158	95	79	27	11	4	115	2386

NOTE. Of the above there were 719 males of twenty years and upwards, 562 under twenty years: of females 525, of twenty years and upwards, 433 under twenty years; and 147 children, principally under one year, whose sex is unknown.

Deaths in each month of the above period.

	Adults.	Children.
January	79	69
February	79	78
March	102	87
April	95	60
May	105	74
June	97	80
July	125	126
August	124	203
September	104	92
October	131	107
November	100	95
December	100	74
Total	1241	1145

By order of the Board of Health,
JOHN ALLISON, Clerk.

Health Office, February 24th, 1812.

It is supposed that the population of the city and suburbs of Philadelphia (within the range of the foregoing Bills of Mortality) founded upon the enumeration of the last census, amounts to about ninety-five thousand.

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A Collection of Treatises on the effects of Sol-lunar influence in Fevers, with an improved method of curing them. By Francis Balfour, M. D. 8vo. Second edition.

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A Popular Treatise on the causes and distinction of the varieties of the Asthma, with new and simple and successful instructions for the prevention and treatment of Asthmatic Fits, &c. &c. By T. M. Caton, M. D.

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Hints for the construction, economy and moral management of an Hospital for the Insane; pointing out the existing defects in such institutions, and proposing means for ameliorating the condition of maniacs. By John Haslam.

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Thomas Dobson has in Press,

The History of North Carolina. By Hugh Williamson, M. D. L. L. D.

Also, preparing for Publication,

Cavallo's Elements of Natural Philosophy. Condensed and improved by the Rev. Mr. Brosius.

A. Finley has in press,

Corvisart on the organic diseases and lesions of the Heart and large Vessels. 8vo. It will be published about the 1st of May.

Charles Bell's Engravings of the Arteries, illustrating the anatomy of the human body, and serving as an introduction to the surgery of the arteries; embellished with fourteen fine engravings. Subscription price five dollars.

THE Editors of the Eclectic Repertory have observed with satisfaction, that selected matter from the most approved European publications, has been timely furnished them to carry on the work hitherto. And as, by late arrangements, they expect to be regularly supplied with the most interesting Medical Journals and Reviews of Great Britain and the Continent of Europe, they can safely promise a continuation of interesting matter, and regularity of publication.

But as part of their plan embraces original papers, they take the present occasion of soliciting such assistance in this way as will enhance the value of the work; and particularly request any notices of the climate and diseases of different parts of our country, and of the many medicinal waters which abound in the United States.

Communications of the above nature may be forwarded to Thomas Dobson, the publisher, No. 41, South Second street, Philadelphia.